DETERMINANTS OF EFFECTIVE UNIT PERFORMANCE

RESEARCH ON MEASURING AND MANAGING [illegible]

Edited by:

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13. ABSTRACT *(Maximum 200 words)* One of the primary missions of the U.S. Army Research Institute for the Behavioral and Social Sciences (USARI) is to conduct research and development to maximize the performance effectiveness of combat units. In recent years, ARI has increased its emphasis on unit-collective training research, recognizing that, although the Army recruits individuals, it fights as units. The research reported in this volume employed a wide spectrum of behavioral and social science techniques for measuring and understanding the performance of units both at their home stations and at Combat Training Centers. ARI's research on unit collective training has not been without challenges. Chief among them has been the development of reliable measurement methods and technologies for assessing unit performance effectiveness. As you will see in this volume, ARI has made considerable progress in its ability to measure performance and in its ability to make reliable statements about the determinants of unit performance at the Combat Training Centers.

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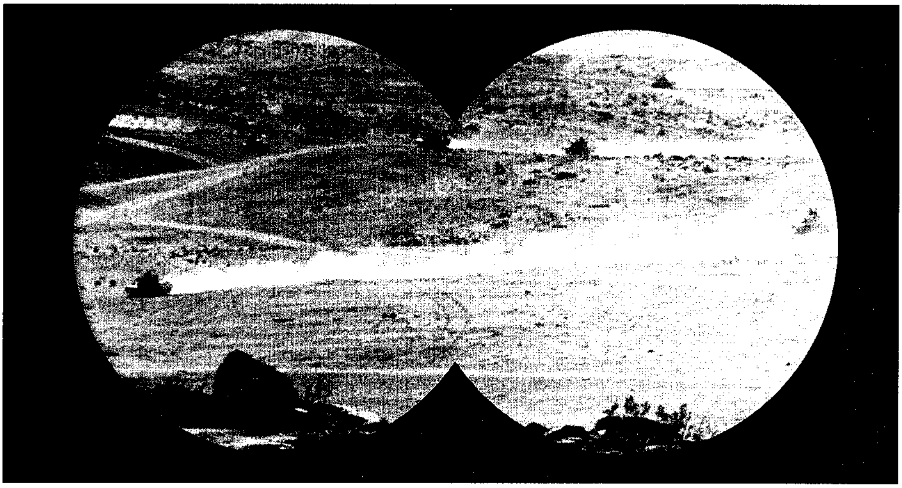
Research on Measuring and Managing Unit Training Readiness



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Robert F. Holz, Jack H. Hiller, and Howard H. McFann

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Contents

Dedication

As this volume was going to press Dr. Howard H. McFann passed away.

During World War II Howard served in the Army Air Corps and flew numerous combat missions. After the War he earned a B.A. in Psychology from Indiana University, an M.A. in Psychology from Oberlin College, and a Ph.D. in Experimental Psychology from the State University of Iowa. His long-term and continuous involvement with military manpower, personnel, and training research began in 1952 when he joined the Human Resources Research Organization (HumRRO). He remained with HumRRO for the next 25 years, moving from Research Associate to Senior Vice President. In 1986 he joined ARI and served as Chief of the ARI Field Unit at the Presidio of Monterey until 1992. In the summer of 1992 he was promoted by OSD to a newly created position of Executive Director, at the formation of the Defense Institute for Training Resources and Analysis where he worked until his retirement in 1994.

Among his many awards and honors is the decoration for Distinguished Civilian Service for his work related to the modern volunteer Army. Howard was a Fellow and Past President of the Military Psychology Division of the American Psychological Association, a member of Sigma Xi, charter member of the Psychonomics Society, and charter member and fellow of the American Psychological Association.

He will be remembered by his friends as a scientist who understood that his work had a purpose—to help make the nation's combat forces better prepared to perform with the skills that achieve victory at the minimum costs in human injury and life. But mostly, we shall miss his good common sense and comradeship.

Acknowledgment

Army training and the research that we have reported in this volume have benefited enormously from the three retired officers acknowledged here.

As the Army's first Deputy Chief of Staff for Training, Training and Doctrine Command (TRADOC), General Paul F. Gorman created the vision of a National Training Center (NTC) that gave birth to the facility at Fort Irwin, California. Included in his effort to advance the effectiveness of Army training was the thrust to move from a classroom instructional focus to a balanced emphasis on performance-oriented unit training. The development and rapid adoption of the Multiple Integrated Laser Engagement System (MILES) in particular was motivated by his vision.

The Combat Training Center data archive that furnished the performance data at the heart of this research report was developed at the direction of then Deputy Chief of Staff for Personnel, General Maxwell Thurman, to then ARI Commander, Colonel Neale Cosby. Later as the TRADOC Commander, General Thurman directed his command to take advantage of the archive by conducting studies on issues in tactical doctrine, training, equipment, logistics, unit organization, personnel quality, and leadership. The direction to use our best full-scale, real-world simulation of combat as a source for checking Army systems and conceptualizing required improvements is a sea change that is yet in the process of forming.

Neale Cosby has provided the positive leadership to move concepts and well-intentioned "briefing programs" into real programs, most notably his work with Jack Thorpe to convert loose engineering concepts on networking into Simulation Networking (SIMNET)—the precursor to the current dynamic expansion of the field of Distributed Interactive Simulation (DIS). Without Neale's leadership, it is safe to say the efforts to build the NTC data archive would never have overcome the many political, technical, and budgetary hurdles it encountered.

Modern Army training owes much to these three visionary officers. The editors here also express their deep admiration and appreciation to them for their help and encouragement over the years.

Foreword

One of the primary missions of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) is to conduct research and development to maximize the performance effectiveness of combat units. In recent years, ARI has increased its emphasis on unit-collective training research, recognizing that, although the Army recruits individuals, it fights as units. The research reported in this volume employed a wide spectrum of behavioral and social science techniques for measuring and understanding the performance of units both at their home stations and at Combat Training Centers. The great support to ARI and the expertise provided by the Combined Arms Command-Training, the National Training Center, and the Joint Readiness Training Center, have been instrumental to the success of this research program.

ARI's research on unit collective training has not been without challenges; chief among them has been the development of reliable measurement methods and technologies for assessing unit performance effectiveness. As you will see in this volume, ARI has made considerable progress in its ability to measure performance and in its ability to make reliable statements about the determinants of unit performance at the Combat Training Centers.

As we continue our research into unit performance issues, our focus remains oriented toward providing useful products for the operational unit commanders as they seek to enhance readiness and for the training development community supporting them.

Edgar M. Johnson
Director, ARI, and Chief Psychologist,
U.S. Army

Contributors

THE EDITORS

Robert F. Holz, Ph.D., is a Senior Scientist in the Training Systems Research Division of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). He is the principal author of the paper on the Determinants of Effective Unit Performance at the National Training Center: Project Overview.

Jack H. Hiller, Ph.D., is the Director of the Training Systems Research Division of ARI. His principal role in the research presented in this text was conceptualizing the opportunity to relate measures of the home station preparation for a National Training Center (NTC) rotation by sample units with the measures of their training performance at the NTC. As Chief of the ARI Presidio of Monterey Field Unit he organized the in-house research program and, with Robert Holz, prepared the contract Statement of Work won by PRC to measure in quantity the home station variables used to predict unit performance at the NTC. He is the author of the papers on Lessons Learned from Combat Simulations; Does OPTEMPO Increase Unit Performance?; and the Epilogue to this volume.

Howard H. McFann, Ph.D., was the Executive Director of the Defense Institute for Training Resources Analysis. His principal role in the research reported in this text was serving as the ARI Presidio of Monterey Field Unit Chief after Jack Hiller, directing the ARI in-house research program, and serving as the Contracting Officer's Technical Representative for the PRC "Determinants" contract. He was also a coauthor of the paper on OPTEMPO.

PAPER AUTHORS AS THEY APPEAR IN THE VOLUME

A Conceptual Framework for Measuring Unit Performance.

Thomas Lewman, LTC, USA (Ret.) is Director, BDM Monterey, ARI Research Division, and was the principal author.

William J. Mullen, III, BG, USA (Ret.) is a Team Leader with BDM Federal, Inc., and was a coauthor.

James Root, LTC, USA is a Military Analyst with BDM Monterey, ARI Research Division, and was a coauthor.

Measurement of Performance at the Joint Readiness Training Center: Tools of Assessment.

Gene W. Fober, Ed.D., is a Research Psychologist with the ARI Field Unit at Fort Benning, Georgia, and was the principal author.

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Does OPTEMPO Increase Unit Readiness?

Major General Lawrence Lehowicz is presently the Deputy Chief of Staff for Combat Developments at Training and Doctrine Command (TRADOC) Headquarters. His role in the research reported was as the Chairman of the General Officer Advisory Group that identified the critical Army issues for the "Determinants" research program. He was also a coauthor of this paper.

Determinants of Effective Unit Performance at the National Training Center: Project Overview.

Francis E. O'Mara, Ph.D., is a Technical Director at PRC. He coauthored this paper and the one titled Application of FM 25-100 Training Management Cycle in Armor and Mechanized Infantry Units.

Application of FM 25-100 Training Management Cycle in Armor and Mechanized Infantry Units.

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Application of the Principles of Training in Armor and Mechanized Infantry Units.

Patrick Ford, M.A., is a Senior Staff Scientist with Human Resources Research Organization (HumRRO) and was a coauthor.

Kent Harrison, Colonel (Ret.) is a Senior Staff Member at PRC and was a coauthor.

Battle Staff Training and Synchronization: The Integration of Functions Critical to Combat Operations.

Thomas J. Thompson, Ph.D., is a Team Leader at the ARI Field Unit, Fort Benning, Georgia, and the principal author of this paper.

Robert J. Pleban, Ph.D., is a Research Psychologist at the ARI Field Unit, Fort Benning, Georgia, and was a coauthor.

Patrick J. Valentine is a Research Psychologist at the ARI Field Unit, Fort Benning, Georgia, and was a coauthor.

Determinants of Courage.

Halim Ozkaptan, Ph.D., is a Research Psychologist at ARI and serves as the ARI Scientific Coordinating Officer to the U.S. Army, Europe. He is the author of this paper.

Providing Unit Training Feedback in the Distributed Interactive Simulation Environment.

Larry L. Meliza, Ph.D., is a Research Psychologist with ARI assigned to the STRICOM Field Unit in Orlando, Florida, and is the senior author of this paper.

David W. Bessemer, Ph.D., is a Research Psychologist with ARI assigned to the ARI Field Unit at Fort Knox, Kentucky, and was a coauthor.

A New Training Paradigm.

Frederic J. Brown, Ph.D., Lieutenant General (Ret.) is a private consultant currently working for the Institute for Defense Analyses and author of this paper.

The Editors express their thanks & appreciation to Ms. Kathryn Fowler, Chief, Publications Office, ARI, and to her staff, for their enthusiasm in preparing this manuscript for publication.

Introduction

Military research has long sought to understand the relationships between preparation for combat and unit performance effectiveness. Such research has been challenging because of the difficulty in spelling out the concrete measures of unit performance. Accordingly, most research and study efforts have in the past been designed primarily to explain individual performance by employing individual factors, such as mental aptitude scores, to predict individual soldier performance, such as rifle marksmanship.

With the establishment of Combat Training Centers which provide for more rigorous training and assessment of unit performance, the opportunity finally arose for research to be conducted on why certain units performed more effectively than others and how unit performance might be enhanced by changes in training methods and management.

In 1987, the U.S. Army Research Institute (ARI) initiated a major research program designed to better understand the effects that selected home-station practices and procedures have on the performance of Army units which conducted training at the National Training Center and the Joint Readiness Training Center. The research program was sponsored by the Combined Arms Command-Training. To ensure that this work would address key Army issues, a General Officer Advisory Group (GOAG) was formed with oversight authority to focus the research. The GOAG was chaired by then Brigadier General Lehowicz, Director of Army Training at Department of the Army Headquarters. Other General Officer representatives were Brigadier General Williamson, Deputy Director of Military Personnel Management, Office of the Deputy Chief of Staff for Personnel; Brigadier General Arnold, TRADOC, Deputy Chief of Staff, Training; Brigadier General White, Forces Command (FORSCOM), J3, Deputy Chief of Staff, Operations; Brigadier General Mullen, Commander, Combined Arms Training Activity, Fort Leavenworth, Kansas; and Brigadier General Funk, Commander, National Training Center.

SECTION I: MEASURING UNIT PERFORMANCE

The papers compiled in this volume provide comprehensive coverage of issues in unit training, following guidance from the GOAG formed for this project. In the first section, papers that focus on the measurement of unit performance—the criterion side of the equation—are presented. Included in Section I are papers by the following: Dr. Jack Hiller, Director, U.S. Army Research Institute Training Systems Research Division, provides information on how lessons learned from units conducting training at Combat Training Centers can be used by units and by the research & development community. The paper by Tom Lewman, William Mullen, Brigadier General (Ret.), and Jim Root of the BDM Corporation presents a conceptual framework that has been used to assess the performance of units conducting training at the National Training Center. Drs. Fober, Dyer, and Salter from the ARI Field Unit at Fort Benning, Georgia, provide a detailed overview of how unit performance assessment has been carried out at the Joint Readiness Training Center.

SECTION II: DETERMINANTS OF EFFECTIVE UNIT PERFORMANCE

The papers presented in Section II all address the home-station determinants of unit performance effectiveness—the predictor side of the equation. The lead article by Drs. Hiller, McFann, and Major General Lehowicz presents quantitative data on how unit operating tempo (OPTEMPO) at home station relates to the performance of those same units during training at the National Training Center. The next three papers present the results found when a variety of home-station training management and training practices, as carried out by armored and mechanized infantry units, werc related to their subsequent performance at the National Training Center. The last chapter in this section, by Thompson, Pleban, and Valentine from the ARI Field Unit, Fort Benning, Georgia, provides critical information regarding the effects that battalion battle staffs have on battle outcomes and the identified need for more rigorous training of battle staffs.

SECTION III: THE HUMAN DIMENSION IN COMBAT

Section III concerns the role of soldier courage in combat. The paper in this section by Dr. Ozkaptan of the ARI Scientific Coordination Office, Europe, is particularly important in that it focuses on the human dimension—the morale, motivation, esprit de corps, fear, and courage—of the individual soldier as a potential force multiplier in combat. It is included in this volume because battle outcomes, while dependent on the achievement of technical and tactical proficiency in the use of modern arms, remain dependent on the less quantifiable and more intangible human dimensions identified in the paper.

SECTION IV: FUTURE OPPORTUNITIES AND NEEDS FOR ARMY TRAINING

The last section of this volume provides a view of Army training opportunities provided by advanced technology on the one hand and of the need and an approach for defending training resource budgets on the other. The first paper by Drs. Meliza, Bessemer, and Hiller of ARI provides information regarding the use of Distributed Interactive Simulation (DIS) to assess unit performance for the purposes of providing training feedback and usable research data. The second paper by Lieutenant General (Ret.) Frederic J. Brown presents a view of the future in terms of a force projection military that uses both analog and digital simulations for training, from the smallest tactical unit to echelons above Corps. The final paper by Jack Hiller provides an epilogue that explains the need for a measurement-based defense of training resources and an approach for doing it.

THE EDITORS

SECTION I

Measuring Unit Performance

The papers that follow portray various approaches for gaining a better understanding of what constitute reliable and valid measures of unit performance and how they may be applied.

The first paper by Jack Hiller, Director of the Training Systems Research Division of the Army Research Institute (ARI), presents an overview of the types of material and information that are collected on units as they conduct rigorous training against an expert opposing force (OPFOR) at the National Training Center (NTC), and of the lessons that can be learned from such training. The existence of a sophisticated instrumentation system at the NTC permits assessment of player position, mortality, and firing events to an extent not currently present at home station. Using the material and information routinely compiled on units engaged in training at the Combat Training Centers (CTCs) can provide doctrine developers, policy makers, and members of the research community with critical lessons not otherwise attainable.

The second paper by Tom Lewman, William Mullen, Brigadier General (Ret.), and James Root of the BDM Corporation presents a summary of research conducted for ARI dealing with the development of a conceptual framework for measuring unit performance at the NTC. The paradigm developed focuses on the three essential phases of unit operations: Planning, Preparation, and Execution. In addition to finding that doctrine and training needed to be reinforced for the phases of planning and preparation, an entirely new construct was invented to simplify unit training measurement and management. The concept of Critical Combat Functions (CCFs), developed as part of this research program, permits a mid-level of measurement and analysis and provides tools for unit training management. The Battlefield Operating Systems (BOSs) currently used by the NTC for training feedback are hard to use because of their macro-level focus. The Army Training and Evaluation Programs

and Mission Training Plans, in contrast, provide too many details to measure and assess. The CCFs, by focusing on the task performance of units by battle phase at a moderate level of detail, provide a more meaningful, as well as more rigorous, methodology for unit performance assessment.

The paper by Fober, Dyer, and Salter from the ARI Field Unit at Fort Benning, Georgia, presents the results of research on the three types of measures used to gather information on unit performance at the Joint Readiness Training Center (JRTC). The review discusses the strong and weak points of the Training & Evaluation Outlines (T&EOs), which are essentially task and subtask listings of all activities doctrinally prescribed for a unit to carry out; the Take Home Packages (THPs), which are narrative documents provided to the commander of a unit following its training at the JRTC and provide information on the observed strong and weak areas the unit should focus on during its home-station training; and the After Action Reviews (AARs), which are conducted immediately after each mission.

Deriving Useful Lessons From Combat Simulations[1]

Jack H. Hiller

Buoyed by the promise of several technological and procedural innovations, Army training officials expect to overcome many of the traditional obstacles to obtaining valid and useful measures of unit performance during combat exercises.

The services have long recognized that the ability to measure the effectiveness of unit combat performance is fundamental to any effort to improve unit training, equipment, personnel, tactical doctrine, or organizational systems design. Without measures of performance effectiveness, officials cannot determine whether policy or procedural changes to the unit structure have helped, hurt, or had no effect. The widely variable conditions of actual or simulated combat, however, together with difficulties inherent in observing and measuring unit performance, have frustrated research undertaken to develop workable systems for measuring unit combat effectiveness.[2]

The issue is of particular concern to the Army's National Training Center at Fort Irwin, California, which affords combat and support units a training environment very much like actual combat conditions. The NTC is accomplishing its primary goal of providing realistic combat training, but some have charged that it is not effectively using data obtained during training exercises as a basis for Army-wide lessons learned.[3] What are the impediments to achieving this secondary, but nonetheless important objective? What is being done to remove them? This paper seeks to answer both questions.

To assess unit combat effectiveness, evaluators have to measure performance within the framework of established doctrine. Unfortunately, the translation of doctrine into performance standards is not a simple, straightforward task. In fact, unit training guides typically avoid precise specification of performance standards for maneuver units and concentrate on task performance procedures instead. The omission of standards or criteria for successful performance is understandable given that training exercises occur in varied terrains, weather conditions, and time frames; also, the exercises feature opposi-

tion forces of different sizes, skills, motivation, equipment, and support structures. While the lack of clearly specified mission performance standards to cover such diverse circumstances is not surprising, it does create a serious measurement problem.

Observers may intuitively feel that certain units are relatively effective or ineffective, but historically the training community has been unable to substantiate these feelings with precise data. This drawback is somewhat analogous to the measurement problem in physics commonly referred to as the Heisenberg Uncertainty Principle. Its three premises are that the process of measurement dynamically affects the object being measured, that the object has many different potential states of existence, and that the object is known only through measurement. Each of these comes into play when one tries to measure unit effectiveness.

In the case of the first premise, special or accelerated training done to prepare for exercises at the NTC, as well as action taken because observers are present during exercises, may result in performance that does not represent typical unit capability.

Instability in unit composition, which results from personnel turbulence and turnover, and the casualties simulated during training exercises are factors that correspond to the second Heisenberg premise, i.e., units are not fixed entities, but change with conditions.

Finally, because accurate measurement of unit effectiveness is extremely difficult to obtain in an ordinary home-station environment, the "snapshots" taken at special exercises, such as those at the NTC, in effect provide the best indicators of a unit's performance effectiveness but only hold when the measures were made.

These impediments to achieving accurate measurement have frustrated efforts to establish unit effectiveness in any absolute sense. The difficulties involved virtually force a strategy of limiting measurements of a unit's effectiveness to selected critical missions that the unit under review performs in a relatively controlled, standard environment. Missions typically trained by battalion task forces at the National Training Center include Movement to Contact, Hasty Attack, Deliberate Attack during day and night, Defense in Sector, Defense from a Battle

Position, and Delay. A description of strategies for assessing unit effectiveness when performing these missions follows.

Using combat simulation, Observer/Controllers (O/Cs) at the NTC are able to train and assess different units performing essentially the same set of missions. The conditions simulated—time allotted, terrain, opposition forces, and material resources—are relatively constant, and the NTC's observers are able to acquire a refined knowledge of doctrinally driven performance requirements. Therefore, analysts should be able to establish valid performance standards acceptable to military experts for each of the critical missions.

Researchers can determine empirically whether performance conditions are sufficiently stable and measures sufficiently reliable to generate data that will yield statistically significant relationships. Significant relationships found between National Training Center performance assessments and predictor variables such as home-station training procedures demonstrate success in our efforts to develop valid effectiveness measures.

The following simple example illustrates the concept of keying performance standards to measurement of results, that is, mission outcomes, rather than to process or procedures. Standards for the Delay mission might state that the battalion task force will

- Block penetration of the enemy for at least A hours after the ground assault has begun (passing score) or for B hours (high pass).
- Suffer no more than C casualties (passing score) or no more than D casualties (high pass).
- Inflict at least Y opposition force casualties (passing score) or Z casualties (high pass).

Using standards patterned after these, analysts can begin to acquire objective unit performance measures.[4]

Assume, for the moment, that O/Cs at the NTC have measured unit performance and, using standards devised for exercises, have determined each unit's effectiveness. In doing so for all missions, the approach generates an unwieldy assortment of criterion effectiveness scores. To reduce this volume of numbers, analysts could create an index for use in scoring cumulative effectiveness in each mission. For instance, analysts

could add together the raw or weighted scores for the standards on each mission.[5] Where appropriate, researchers could then combine the indices, weighted as necessary, to form an omnibus criterion variable.

In conducting studies, analysts could use omnibus criterion variables as overall measures of a unit's performance effectiveness or capability. They could, for example, determine the reliability of measures of a unit's general characteristics, e.g., command climate, leadership styles, or level of personnel turbulence and fill, as predictors of unit effectiveness. Conversely, to obtain predictors of unit performance effectiveness that reflect specific unit characteristics, e.g., the age of its weapons, levels of personnel fill in selected job specialties, and amount of emphasis placed on training particular tactical skills, analysts would use as the criterion an index based only on the relevant mission or mission standards.

Working with the data collected during training exercises, analysts can identify patterns of strength or weakness in training, personnel and organization, tactics and operations, equipment, and logistics. Trainers at the NTC use these data in After Action Reviews (Socratic discussions held immediately after engagements and widely credited as the best approach for learning from experience). The data are also incorporated into Take Home Packages to help units improve home-station training programs. In addition, analysts sometimes collect a limited amount of data on specific issues and aspects of a mission (at a so-called Focused Rotation).

Because data collection does not take place in a controlled, test-like environment, the data often contain certain errors and deficiencies that limit their application to other research efforts. Missing or incomplete data is a problem, particularly in the case of the Multiple Integrated Laser Engagement System (MILES), which simulates weapons firing by means of beams and sensors rather than ammunition. Unlike ammunition on an actual battlefield, laser beams do not always penetrate the smoke and dust of a simulated battlefield; consequently, the fidelity of direct-fire weapons simulation and the validity of the data are degraded.[6]

Also, because indirect fire and air-defense artillery are not yet instrumented, scorers have to resort to old-fashioned guesswork in evaluating the battlefield effects of these weap-

ons. In addition, some weapons systems (and most individual soldiers) are not instrumented, further limiting the value of the data. Data loss once again becomes a problem when terrain features block vehicle radio transmissions relating to troop positions and firing activity, but new digital data systems operated through satellites should curtail this particular problem.

Trainer interventions may skew the data. The trainers who stage and manage exercises in order to create good training actively influence battle outcomes. For instance, if certain actions or maneuvers become so bogged down that they consume an inordinate amount of training time, O/Cs may direct the opposition forces to change their behavior. Similarly, they may invoke a notional enemy in order to alter the behavior of friendly forces. Or, trainers may simply order the friendly forces to simulate action.

Perhaps trainers have the greatest impact during simulated action when they "revive" and "kill" leaders and soldiers in order to maximize the value of the training.[7] Trainers can resurrect a dead junior officer six or seven times during a battle in order to give him additional opportunities to learn and gain battlefield experience. Clearly, trainer intervention affects battle outcomes and complicates data interpretation. This is not to say that trainers should refrain from actively controlling exercises to achieve maximum learning opportunities at the NTC. It should, however, serve as a caution against broadly and simplistically applying battle outcome data obtained from these exercises.

To avoid making invalid, subjective conclusions about the effectiveness of units engaged in simulated combat, analysts must use performance criterion measures derived from objective battle outcome data. But even beyond the data generation and collection deficiencies discussed above, battle outcome measures do not readily translate into explanations of performance. By contrast, data pertaining to the actual task performance of units, unit leaders, and equipment are more meaningful and relatively easy to interpret.

Although the NTC does not now collect such data because of the burden that task would impose on trainers, a technological innovation may soon change the situation. In 1991, using funds provided by the Office of the Assistant Secretary of Defense, Force Management and Personnel, and the Operational

Test and Evaluation Command (OPTEC), ARI continued development of an electronic data collection device.[8] It is a field-portable, hand-held device that presents checklists (selected by menu) and records the scores a unit earns on each checklist item. Trainers enter scores using a touch-screen display and can feed the stored data directly into a larger computer when convenient. The device will enable trainers and observers in the field to collect data on general and specific topics, which in turn should greatly aid service officials in formulating lessons learned.

When analysts use task performance measures, the accuracy of the resulting estimates of unit effectiveness depends upon the observers' ability to see activity on the simulated battlefield. Given the limited number of observers available and the difficulty of seeing vehicles and soldiers covered, concealed, or cloaked in darkness and smoke, task-based measures are often incomplete. Furthermore, variations in performance conditions affect how units act and how closely their actions conform to tactical doctrine as described in the Army Training and Evaluation Program.

Likewise, uncontrolled or random variations in conditions under which soldiers perform the same mission may significantly affect battle outcome measures. The variations may stem from luck, the availability of good intelligence, the success of opposition forces in attacking an uncharacteristically weak point, or atypical weather. Consequently, it is desirable to allow military experts to amend objective estimates of unit performance effectiveness in light of battlefield conditions. Current plans call for using experts—experienced commanders—to rate unit effectiveness on the major operating systems such as fire support, intelligence, air defense, mobility and countermobility, and command and control, as well as on nuclear, biological, and chemical systems. Subsequently, these experts will give unit performance an overall effectiveness rating and provide explanations for any scores outside a neutral or mid-range value.

The commanders will use two frames of reference. First, drawing on personal experience, they will rate units on a relative scale. For example, the high end of the rating scale might be "one of the best performances." Because any given expert's experience may relate to generally very good or very poor units, the raters will use a second frame of reference pegged to com-

bat proficiency. The high end of that scale might be "completely effective performance," and the low end, "completely ineffective."

In making these assessments, the expert raters will review the mission orders, the digital data tapes fed through the computer system that displays vehicle positions and firing events, the synchronized radio-net audio tapes, map overlays, and documented comments from the NTC staff that indicate any special conditions. Researchers at the NTC will use averaging to reconcile differences in the experts' ratings. Where ratings are extremely discrepant, researchers will look to the experts' narrative comments for insights into how best to interpret the data. Clearly, the use of experienced battlefield commanders to observe and judge recorded exercises at the NTC promises to alleviate some of the data collection and data interpretation deficiencies inherent in a strictly mechanical performance measurement system.

Although the realistic combat simulation achieved at the NTC facilitates effective unit training, it offers only limited opportunities for acquiring high-fidelity measures of unit performance, as we have discussed above. Fortunately, a new combat simulation system now being developed by the Army will make possible the kind of precise measurement not attainable in actual field exercises. Moreover, it will do so without any intrusion from data collectors. As its name suggests, Simulation Networking, or SIMNET, is an integrated network linking together various battlefield weapons systems simulators. Eventually, the network may comprise hundreds of simulators for all major weapons systems. This will enable trainers to conduct force-on-force exercises on a combined-arms, battalion task force scale (as is possible at the NTC) or larger.

Each simulator in the network has a video-display screen that realistically depicts the battlefield terrain, as well as any systems and vehicles in the operator's simulated line of sight. Through real-time, computer-generated imagery, any maneuvering, firing, and changes in speed or position that an operator of one simulator initiates are automatically projected on the line-of-sight display screens of the other simulators in the network. Realistic sound effects and vibration add to the fidelity of the simulation.

SIMNET records exercises in their entirety, thereby enabling trainers and researchers to replay each simulated battle and systematically analyze the data it generated. By incorporating mission scenarios similar to those at the training center, training officials expect to use the Simulation Networking in tandem with the performance measurement system that the Army Research Institute and the Combined Arms Training Activity are developing for the Center. (See the paper by Lewman, Mullin, and Root in this volume.)

The great potential of SIMNET for generating high-fidelity data increases the feasibility of conducting research on the new measurement performance system itself. (See the paper by Meliza, Bessemer, and Hiller in Section IV.) For example, SIMNET will reveal the degree to which observations and judgments of military experts are consistent with the systematically calculated assessments that analysts will make using the objectively scored performance and mission outcomes. Analysts will also be able to determine the degree of consistency for objective and behavioral performance measures and for overall ratings of unit performance effectiveness.

The National Training Center produces data that describe the performance of units, their leaders, and their equipment during simulated combat missions. Together, data from the NTC and from the SIMNET technology promise to provide new insights into the interactive performance of complex weapons systems used by units to execute various critical combat missions.

Notes

1. An earlier version of this paper was published in the *Defense Management Journal* for the Second and Third Quarter 1987, p. 28.

2. See, for example, S.K. Wetzel Smith and S.R. Mitchell, *Collective Training Standards Development: Problem Analysis*, Technical Report 86-26 (San Diego, CA: Navy Personnel Research and Development Center, 1986) AD-A169 757.

3. A notable example of such criticism is the General Accounting Office's report entitled *Army Training: National Training Center's Potential Has Not Been Realized*, GAO/NSIAD-86-130 (Washington, DC: General Accounting Office, July

1986); for a summary of the report, see the Fourth Quarter 1986 issue of the *Defense Management Journal*, p. 41.

4. The scoring scale of pass, high pass, and fail represents an expansion of the two-point scale currently used in the Army Training and Evaluation Program. Obviously, further graduation of the scale is possible and would be consistent with the Army Science Board's summer 1985 study of training and training technology, which recommended expansion of measurement scales beyond the dichotomous GO-NO GO. In fact, because the raw percentage scores for force casualties will likely form a normal distribution, researchers can rescale the actual performance data to standard Z scores and use them directly without first converting to GO-NO GO categories.

5. By converting raw scores to Z scores for each standard, analysts could equalize the variance contribution for data from each standard to the total score for each mission.

6. For a comprehensive discussion of training with the Multiple Integrated Laser Engagement System, see Robert Sulzen, "Winning the Airland Battle with Tactical Engagement Simulation," *Military Review*, May 1987, pp. 8–19.

7. See, for example, the article on Commander Survivability by Robert Holz in the January 1993 issue of *Military Review*.

8. The Jet Propulsion Laboratory was the contractor for development of the initial electronic clipboard in 1987. Perceptronics was the primary subcontractor.

A Conceptual Framework for Measuring Unit Performance

Thomas Lewman,
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James Root

I. INTRODUCTION

How can the Army maximize training benefits from large-scale combined arms simulated exercises?

Performance feedback is vital in maximizing the training benefit of these exercises. Systematic measurement and observation by expert trainers is required to accomplish effective training feedback. In more general terms, accurate measurement of combat effectiveness has long been recognized by the Army as critical to at least three objectives: (1) determining the combat readiness of units; (2) assessing the training status of units and identifying needs for subsequent training; and (3) identifying improvements in doctrine, training, organization, material, and leadership that will contribute to greater success on the battlefield. This paper describes recent developments in how unit performance may be conceptualized so that more precise and usable measures of performance can be implemented by the Army.

Background

In 1876, Lieutenant Colonel George Custer led the 7th Cavalry into the Little Big Horn Valley where he unexpectedly met 4,000 angry Indians. Custer's command was destroyed. About a hundred years later in 1965, Lieutenant Colonel Hal Moore led the 7th Cavalry into the Ia Drang Valley where he unexpectedly encountered 4,000 angry North Vietnamese. Although it was a close call, Colonel Moore and his men emerged victorious.

For centuries armies had to rely on actual combat to assess realistically their leadership, training, and organization. While often costly, no other method of evaluating unit performance in combat existed except by actually doing it. The

construction of the Combat Training Centers resolved much of this problem and provided an opportunity to routinely assess and improve a wide variety of operational methods and materiel that were impossible to evaluate using previous methods. The effectiveness of CTC training can be shown by the decisive victory during the Gulf War. Soldiers were often heard saying that war at the NTC was great preparation for Desert Storm.

Shortly after the National Training Center became operational at Fort Irwin, California, the Army Research Institute began seeking ways to exploit and enhance the value of the training conducted there. The idea was to assist the NTC in developing a mechanism which would allow the lessons learned from the individual training rotations to be fielded throughout the rest of the Army. This mission was assigned to the ARI Field Unit at the Presidio of Monterey (ARI-POM).

By the mid 1980's, the NTC was a dynamic training environment. The NTC is located in the spartan terrain of Southern California's Mojave Desert and covers an area roughly the size of Rhode Island. The NTC's 1000-plus square miles permit battalion commanders to deploy their combat power in task force formations. The NTC cadre consists of a highly trained resident Opposing Force (OPFOR) capable of replicating a Soviet Motorized Rifle Regiment and a training group of Observer/Controllers who are organized to mirror the leadership of exercised units. These highly trained and experienced O/Cs follow each unit to provide control of the exercise and assess training performance. Army units cycling through the NTC are typically configured as a heavy brigade with an armor and a mechanized infantry battalion task force. Appropriate slice elements, such as artillery and engineer units, accompany the brigades as they would if it were a deployment to a combat zone.

One aspect of the NTC training environment that makes it unique is the level of instrumentation available for each rotation. All individuals and equipment (OPFOR and BLUFOR) participating in a rotation are outfitted with MILES. The MILES equipment is designed to duplicate the capability of weapons by using an invisible laser beam in place of live ammunition. The MILES allows the recording of direct fire engagements and their resulting hits by whom, when, and at what range. This allows for a level of realism unavailable in previous training exercises.

In addition, all combat vehicles are linked to an antenna grid that covers the training area and which feeds a myriad of data, such as position-location, firing, communications, and vehicle status, to a central computer facility known as the Training Analysis Feedback (TAF) center. Using this instrumentation, military analysts at the TAF can observe the battles being conducted in the training area on a computer screen as well as monitor unit communications. The combination of the TAF capability and the O/Cs, who are physically accompanying the units, gives the Army the unprecedented ability to track all aspects of a mission from start to finish.

At the ARI Field Unit, Monterey, research has focused on how best to capture the data being generated at the NTC and convert it to an accessible format which would provide the foundation for future research, studies, and analyses. There are two main parts of this effort: First, identification of *what* happened and, second, *why* it happened—essentially, a cause-and-effect relationship. The *what* component is relatively simple since the instrumentation provides a clear picture of each battle. The *why* aspect, however, is more cloudy and frequently buried in a variety of sources—O/C notes, After Action Review videos, communication tapes, and Take Home Package narratives. Even so, the necessity to identify and measure the elements of *why* remain critical. Without this assessment, no other way exists to determine whether training was correctly tailored and whether equipment met current requirements. It is the only way to identify systemic issues that had been overlooked or under researched. Finally, such research can provide the basis for identifying and addressing the lessons learned and provide a structure for disseminating them to the balance of the Army.

Identifying the elements of *why* initially proved elusive. The problem was tactics. While a number of tactical techniques, drills, and procedures were routinely used, the variations, sequencing, and timing of their use may or may not have been appropriate to the tactical situation. In addition, the number of input, process, and output tasks required of any single participant during a mission was virtually infinite. In short, the conduct of the missions on the NTC battlefield was extremely fluid and rapid with hundreds of moving parts, each operating in reaction to a myriad of stimuli. The challenge was

to identify the *critical* actions and to organize them into some form of quantifiable structure.

The approach taken was to construct a system that mirrored the training feedback process already in use at NTC, the primary component of which was the After Action Review. AARs are done following each mission (of which there are typically nine during a rotation) and are given at the platoon, company/team, and battalion task force levels. AARs for each mission were examined in terms of the planning, preparation, and execution phases as they related to each Battlefield Operating System (BOS) (Intelligence, Maneuver, Command & Control, Fire Support, Air Defense, Mobility/Counter-Mobility/Survivability, and Combat Service Support) and by critical event.

One other important aspect of the AARs was that they were keyed to doctrinal issues rather than tactical ones. As an example, Army doctrine states that units must maintain mutual support. That is, the various elements within a unit must be able to cover each other, or at least be able to immediately move to a location where they can cover each other. How they do it (techniques, drills, and procedures) is through tactics. Once the NTC training feedback process was understood, it was then possible to develop a framework for conceptualizing the measurement of unit performance which could provide appropriate and comprehensive data for follow-on research, studies, analyses, lessons learned, and future training developments.

At ARI-POM, specially developed databases provide a data source for conducting analysis and research for the improvement of training, doctrine, organization, and equipment. Particular issues can be investigated as well as the maintenance of trendline data on performance of units and weapons systems at NTC. In accordance with DA Regulation 11-33, ARI-POM maintains an archive of data from the NTC as well as the other two tactical CTCs (the Joint Readiness Training Center and the Combat Maneuver Training Center). ARI-POM currently has archival data from NTC since the first rotation when systematic data was collected (83-1). Some 12 brigade-size units rotate to NTC each year. The present NTC portion of the CTC Database represents more than 700 battalion and brigade task force missions. Like type performance and battlefield historical data is archived from the other two CTCs. It was from this data that we

began our research into using force-on-force tactical engagement simulation exercise data to develop a conceptual model for the measurement of unit performance.

II. IDENTIFYING THE SCOPE OF THE EFFORT

Missions. Missions are the context in which critical tasks are performed. In order to determine which missions would provide the basis for the unit measurement study, a survey was conducted of all battalion task force missions conducted at the NTC through 1986. Three missions emerged as being done in virtually every rotation: Defend, Deliberate Attack, and Movement to Contact. Two others, Hasty Attack and Night Attack, were conducted frequently enough (over 10% of the time) to be included in the mission list.

Echelons. The battalion task force is the central focus of training at the NTC. As a result, this echelon became the centerpiece for the unit performance measurement effort. Information for subordinate company/teams and platoons is included since they are an integral part of the battalion and their exclusion would significantly restrict a substantial amount of critical data. Echelons above battalion (i.e., brigade) level were not examined because the scope of their activity was so broad and because of limited O/C coverage.

III. MISSION CRITICAL TASK IDENTIFICATION AND DEVELOPMENT

Our overall research strategy was to "look at" units from various perspectives. The five major unit perspectives were

Input—Input is the type of effort involved, such as resourcing of equipment, materiel, fuel, ammunition, training facilities, and number and quality of personnel.

Output—Output is the achievement of objectives such as number of exercises completed or unit proficiency.

Process—Process includes the management and training techniques used to obtain quality of performance for given interrelated inputs.

Effectiveness—Effectiveness is the measure of the output in relation to the need, such as meeting Army task standards.

Efficiency—Efficiency relates the outputs to the inputs and the process. In this area researchers examine the most efficient way to use input and processes to achieve desired output.

A key element in our research was the use of **expert judgment**. The Observers/Controllers at the NTC provide comments and data both in AARs and THPs in the form of subjective performance assessment at the collective level. These serve as the best source for providing overall judgments and specifics as to critical factors associated with unit performance.

Doctrinal tasks. The initial step in developing critical doctrinal tasks was the analysis of the doctrinal principles to determine underlying rationales which would serve as the basis for the construction of tasks. Using the results of this analysis and the information gleaned from a more detailed analysis of combat, combat support, combat service support manuals, and applicable NTC documentation, a list of doctrinal tasks critical to the successful accomplishment of each mission by a battalion task force was prepared.

Each battalion task was then examined for implications and requirements regarding the critical tasks for subordinate elements—the company/team and platoon. In addition, a top-down analysis of the battalion tasks, following a dendritic approach, assisted in the identification of tasks (and task constructs) that task force elements down to platoon level must perform in order for the battalion critical tasks to be accomplished. Appropriate field manuals and NTC documentation were used in the development of critical doctrinal tasks for company/team and platoon echelons. In this manner, mission critical doctrinal tasks were developed for each mission and for each echelon (battalion task force, company/team, and platoon).

Operational tasks. Once the doctrinal task list had been developed, it was necessary to develop experienced-based task lists. These operational tasks were developed through structured interviews with subject matter experts (SMEs) from the NTC, an active Armor Division, and the Infantry School.

National Training Center. The SMEs provided by the NTC were Observer/Controllers, the most knowledgeable group of SMEs in the Army for the purpose of this research. Their mission was to accompany exercise units and assess, teach, coach,

and interact with task force personnel throughout the course of each rotation.

Infantry School. SMEs provided by the Infantry School were personnel who were the formulators, writers, and instructors of Army doctrine. These officers not only possessed expert knowledge of doctrine and how it is operationalized in the field, but had a deep insight into NTC training methodology and operations.

Active Armor Division. The data collection effort focused on the gathering of critical task information formulated on NTC and home-station training experience. The SME experience level extended from a brigade commander to the battalion task force commanders, brigade/task force staffs, slice element leaders, company/team commanders, and finally to the maneuver platoon leaders. Input from the task force and brigade commanders was obtained through structured interviews, while data from their subordinate staffs and leaders was gathered using the "brainstorming" technique discussed below.

The same procedures were established and followed at all data collection sites. Each SME was assigned to a group based on his assignment within the respective organization and experience level. All seven Battlefield Operating Systems were represented by seven groups of SMEs. Each group of SMEs was responsible for establishing a list of critical tasks, representative of its particular area of expertise, for all missions, by echelon (battalion task force, company/team, and platoon) and by functional mission phases (Plan, Prepare, and Execute). All groups of SMEs participated in a "brainstorming" session, during which time each participant spent about fifteen minutes compiling an individual list of critical tasks associated with a particular mission. Each individual list was then posted on butcher paper. Once all the lists were posted, the group was asked to add to the list any critical tasks that had been omitted. All tasks on the consolidated list were then reviewed for clarity, redundant tasks were noted, and part-whole relationships between tasks were recorded. SMEs indicated the specific function (planning, preparation, and execution) each task fulfilled and verified the echelon responsible for performing the task. Thus, the tasks listed on the butcher paper became the field lists of critical tasks for a specific echelon by operating system.

Integration of the tasks lists. The research team reviewed and analyzed each list of mission critical tasks. Every task on a list was clarified, refined if necessary, and transcribed into a clearly stated task statement. Each list was then reexamined. Redundant tasks were deleted. Tasks which appeared to be subtasks of other tasks were listed under their parent tasks and were noted as possible measures of performance (MOPs). Concurrently, MOPs generated from notes were developed for each task. The task was then restated in a standard task format as an action verb followed by a product or process (e.g., Analyze the Terrain). For each mission, the task lists derived from the various sources were aggregated by echelon, operating system, and the functional phase of the mission.

This integration process produced, for each of the five missions, a candidate list of mission critical tasks. Each list contained critical tasks for the battalion task force, company/team, and platoon categorized by functional phase (Plan, Prepare, Execute) and Battlefield Operating System. Finally, each candidate list was reviewed against the list of doctrinal principles to ensure that these principles had been operationalized by critical tasks. An example of a deliberate attack mission at platoon level for the planning phase is presented in Figure 1.

A committee of SMEs also designated criticality ratings for each mission critical task. All tasks were evaluated against mission and survivability criteria. One scale rated each task for its importance to mission accomplishment while the other rated each task on its importance for combat survivability. These ratings provided a means to determine task priorities and importance. By identifying what single or cumulative factor determined criticality, a system for establishing task values was set up. A single value of 5, or a cumulative value of 6 or higher (on a total ten-point scale) caused the task to be selected for retention.

Figure 1. Example of planning tasks at platoon level for a deliberate attack mission.

Mission: Del. Attack	**Echelon: Platoon**	**Phase: Planning**
Planning Phase Tasks		

1	Conduct Mission Analysis.
2	Derive Commander's Intent.
3	Initiate Planning Process.
4	Issue Warning Order.
5	Integrate Engineer Effort Into Command and Control System.
6	Determine Combat Service Support Requirements.
7	Conduct Mobility Analysis.
8	Establish Air Defense Priorities.
9	Conduct Leader's Reconnaissance.
10	Conduct Terrain Analysis.
11	Update Administrative and Logistical Status.
15	Plan Combat Service Support.
18	Prepare Engineer Estimate.
19	Prepare Intelligence Estimate.
20	Develop Air Defense Estimate.
21	Establish Priority of Fires.
22	Develop Tentative Plan.
23	Plan for Nuclear, Biological, and Chemical (NBC) Operations.
24	Plan Evacuation.
28	Develop Reconnaissance and Surveillance Plan.
29	Establish Reporting Criteria.
30	Supervise Fire Support Planning.
31	Organize for Combat.
32	Coordinate Plans With Adjacent Unit.
34	Develop Mobility Plan.
35	Develop Air Defense Plan.
36	Develop Fire Support Plan.
38	Plan Maneuver Control Measures.
39	Plan for Control of Supporting Units.
40	Plan Communications.
41	Establish Task Force Early Warning System.
52	Plan Fire Control Measures.
55	Plan Screening Fires.
56	Plan Actions on Contact.
57	Plan Movement Security.
58	Plan Movement Formations and Techniques.
59	Plan Passage of Lines.
68	Integrate Fire Support With Scheme of Maneuver.
69	Plan Fire Support for Advance Guard.
70	Plan Advance Guard's Employment.
75	Issue Operations Order.
76	Graphically Illustrate Scheme of Maneuver.

IV. DEVELOPMENT OF TASK STRUCTURE, STANDARDS, AND MEASUREMENT PROTOCOLS

Prior to describing the details of the technical approach for this portion of the measurement system, it is necessary to delineate the objectives and constraints that were considered in developing the MOPs and standards. First, it was important to minimize changes in the dendritic structure for the critical tasks. This structure resulted from a rigorous developmental effort and was considered to be in nearly final form. However, if it were found to be necessary to make such changes, it was imperative that any new or modified tasks could be categorized as leader, staff, or collective tasks, as opposed to being individual soldier tasks. Second, it was necessary to develop MOPs and standards that would be consistent in terms of wording, format, and level of abstractness. Third, it was important to employ objective measures for the MOPs whenever possible. That is, the measures should be directly observable and, if possible, they should not be open to various interpretations on the part of trained observers.

An initial step was to produce standard formats for the MOPs and standards in order to ensure consistency. These formats were simple structures that were intended to serve as guides in writing the MOPs and standards for each task. The basic structure for the MOPs consisted of a statement of a desired outcome (referred to as a performance standard) for the task and a corresponding scoring protocol. As an example, for the task "Position fire support forces," the first MOP statement or performance standard is "Mortars are repositioned, when necessary, to effectively cover the force." The second performance standard reads, "Artillery is repositioned, when necessary, to effectively cover the force." For each of these MOPs, the scoring protocol degree of effectiveness is referenced in the performance standard.

The grammatical structure for the MOP statements and performance standards varied; however, the grammatical structure for the task standards was relatively consistent. Task standards were written in the passive voice and included a subject, predicate, object, and, if necessary, a prepositional phrase. For the task "Position fire support forces," the task standard was "Fire support forces are repositioned to continuously support the maneuver elements."

When writing a MOP statement or performance standard, the researchers would first select the appropriate scoring protocol for a particular aspect of task or subtask performance. The performance standard would then be written and, if necessary, the scoring protocol for the MOP would be revised. Scoring protocols were adapted to specific MOPs in only a few instances. Having written all of the performance standards for a particular task, the next activity would be to write an overall standard for the task that encompassed all of the desired outcomes. In other words, the task standard is intended to be a "roll-up" of all of the performance standards for that task. Also, the description of task performance given in the task standard is to be more general than the descriptions of the individual performance standards.

Having specified the procedures to be followed, it was then necessary to test the tools, activities, and decision rules on a sample of tasks. After making some minor modifications based on the tryout, the tools and procedures were applied to all critical tasks at platoon, company, and battalion levels. As the MOPs and task standards were being written, all of the required information was recorded on the MOP input forms and entered into the database. Once the MOPs and standards had been developed for each of the critical tasks for a given echelon, it was necessary to review and revise the entire set in order to ensure consistency for the initial draft.

A final step in this portion of the development process was to have the MOPs and standards reviewed by other Subject Matter Experts and to incorporate any necessary revisions into the final product.

V. DEVELOPMENT OF MISSION CONDITIONS

In order to complete the development of critical tasks, it was necessary to establish the conditions under which the respective tasks were performed. Several methods were examined to facilitate the organization and linkage of conditions to respective tasks.

One approach was to assign a condition to each task, thereby structuring each task as an independent entity. This was the method used by the developers of the Army Training and Evaluation Plan/Mission Training Plan (ARTEP/MTP)

manuals and provided a start point for the research. However, three problems surfaced using this method.

First, each task was not an independent entity, but interrelated, both directly and indirectly, with every other task necessary for the accomplishment of a mission. Further, at each higher echelon many separate tasks became so interactive that it was impossible to isolate independent conditions.

Second, there were several hundred identified critical tasks performed by the platoon, company/team, and battalion task force echelons. Since there were five different missions commonly exercised, the several hundred would have to be multiplied by five with a set of conditions tied to each task. In addition, any alterations to a specific task would typically force alterations to the conditions as well. Such a volume would be so cumbersome as to render it nearly useless both to the military and research communities.

Finally, conditions would have to reflect all the various options under which a task could be performed. In effect, the user would first have to review all the tasks and then, based on the stated conditions, determine which were applicable to the mission being conducted.

A second method for development of conditions was to create terrain-specific conditions. That a desert environment is different than a jungle environment is self-evident. However, the tasks were designed to be doctrinally based and mission specific. The task of Issue an Operations Order, for example, was directly tied to the standards of timeliness and completeness, whether it was given in the jungle or the desert.

Even so, it was clear that conditions of some nature were necessary to frame the critical tasks in the correct context. Since the tasks had been identified by mission, that format was examined. That is, the mission, rather than the task, became the central focus of the conditions. This structure allowed a firm doctrinal base for further analysis. Therefore, conditions were addressed by developing a mission scenario which would establish the task organization, initial location, and general orientation of the unit at the receipt of the warning order. This would provide a broad context for the mission and serve as the activation point for the balance of the events.

However, there remained a requirement to narrow the focus below the overall mission outcome and above the individual task accomplishment. This led to an examination of the mission flow and the development of phase segments.

VI. DEVELOPMENT OF THE BATTLE FLOW FRAMEWORK

The cadre at the NTC had been using the mission phases of plan, prepare, and execute to observe and train units for some years. This represented a logical flow for all missions and appeared useful for organizing both the critical tasks and developing a structure for their collective outcomes.

The mission event sequence. To ensure that the Battle Flow Framework would incorporate fully all identified tasks for all echelons for all missions, a mission-event flow chart was developed for each echelon by respective mission. The event sequence followed the standard Army Troop Leading Procedures for the planning and preparation phases. The Troop Leading Steps are as follows:

1. Receive the Mission
2. Issue the Warning Order
3. Make a Tentative Plan
4. Initiate Necessary Movement
5. Reconnoiter
6. Complete the Plan
7. Issue the Order
8. Supervise and Refine the Plan

Steps one through seven are planning actions. Step eight is done during mission preparation. The entire process is guided by analysis and confirmation of the factors of METT-T (**M**ission, **E**nemy Forces, Friendly **T**roops, **T**errain, and **T**ime). The mechanism for addressing the execution phase was the normal battle sequence. This can best be described as an attack-defend, or action-reaction, dynamic event flow.

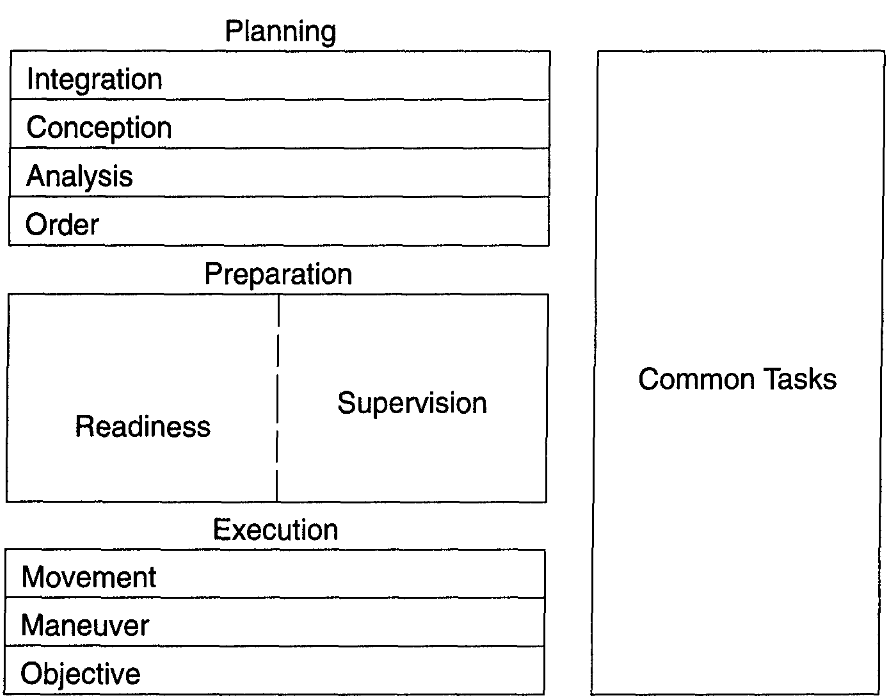
Based on this outline, these flow charts were used to identify decision and process points in a step-by-step sequential order from receipt of the mission through the end of the mission. In addition, because they were both mission and echelon specific, they highlighted echelon differences within the same mission. As an example, during a deliberate attack, the task force

is certain to experience enemy indirect fires. However, a specific platoon may or may not experience any. The mission-event flow charts served to clarify these relationships.

Once the mission-event flow charts were completed, they served as an overlay for the mission phases already identified in the battle flow chart. What emerged was a clear picture of operational events as they occurred through a respective mission. In addition, this structure served to define the start and end events for each phase. It also became apparent through this process that the mission phases could be subdivided into smaller segments. This was desirable in that it allowed for a clearer definition of each step in the mission flow and would provide a more definitive condition structure.

Mission segments. To construct the mission segments, each mission phase was examined in detail. (See Figure 2.) For the planning phase three primary sources were used: The Mission Event Charts, the Troop Leading Procedures, and the Military Decision Making Process, which essentially served as the

Figure 2. Battle Flow Framework.



staff model of the Troop Leading Steps. The result of this effort was the construction of four segments in the planning phase: Conception, Analysis, Integration, and Order.

Conception involves the initial understanding of the mission and its requirements. Analysis involves the information gathering aspects guided by the factors of METT-T. Integration is the process of tying together all the components into a team effort. Order refers to the presentation and understanding of the combat operations order.

Based on the Troop Leading Procedures and the Military Decision Making Process, Supervision was already identified as a segment in the preparation phase. The other major segment consisted of those readiness activities being supervised. Unlike the sequential pattern seen in the planning phase, both the readiness activities and their supervision are highly interactive and done simultaneously. Hence, the two segments identified for the preparation phase (Supervision and Readiness) are presented in a concurrent rather than sequential mode. Readiness addresses the various direct actions necessary to ensure the unit is prepared for the mission. Supervision focuses on the chain of command's efforts to ensure readiness and confirm all aspects of the plan.

The execution phase was examined against the actual flow of a battle. In an attack, the attacker moves from an assembly area to the line of departure. Beyond the line of departure, the attacker maneuvers to the objective area. Once there, the attacker assaults to seize the objective. A unit in the defense reacts to this sequence and attempts to defeat the attacker during the attacker's movement, maneuver, and actions at the objective. Despite the role reversal, the execution sequence remains the same, and the three segments identified in the execution phase are movement, maneuver, and objective.

Segment purpose and outcome. Having identified the primary activities conducted within each phase, it was now necessary to identify the purpose and outcomes associated with each segment. Since each segment represented a sequential step through the mission and represented the collective achievement of all the tasks within it, identifying the purpose and outcomes of the segments provided a more focused view of a mission narrower than that which could be derived from the

phases, yet broader than that afforded by a comprehensive task-by-task examination.

With this in mind, each segment was assigned a purpose which outlined what activities should occur during the segment. Similarly, each segment was given an outcome measure which broadly stated those actions which should be achieved when all the segment's subordinate tasks were accomplished.

VII. TASK SEQUENCING AND LINKAGE

Task sequencing. Once the tasks had been identified and grouped by echelon and mission, and with the development of a mission structure, it was now possible to insert the tasks as they would logically occur. (See Figure 3.) Tasks for each echelon and mission were thus arranged on a mock-up mission board. This effort clarified two aspects of the tasks not fully appreciated in earlier work. First, some tasks, such as Report Combat Information, are done throughout the mission and could not be appropriately placed in the plan, prepare, and execute phases. Their continuous nature caused a sidebar segment to the Battle Flow Framework which was labeled Common, as in common to the overall mission.

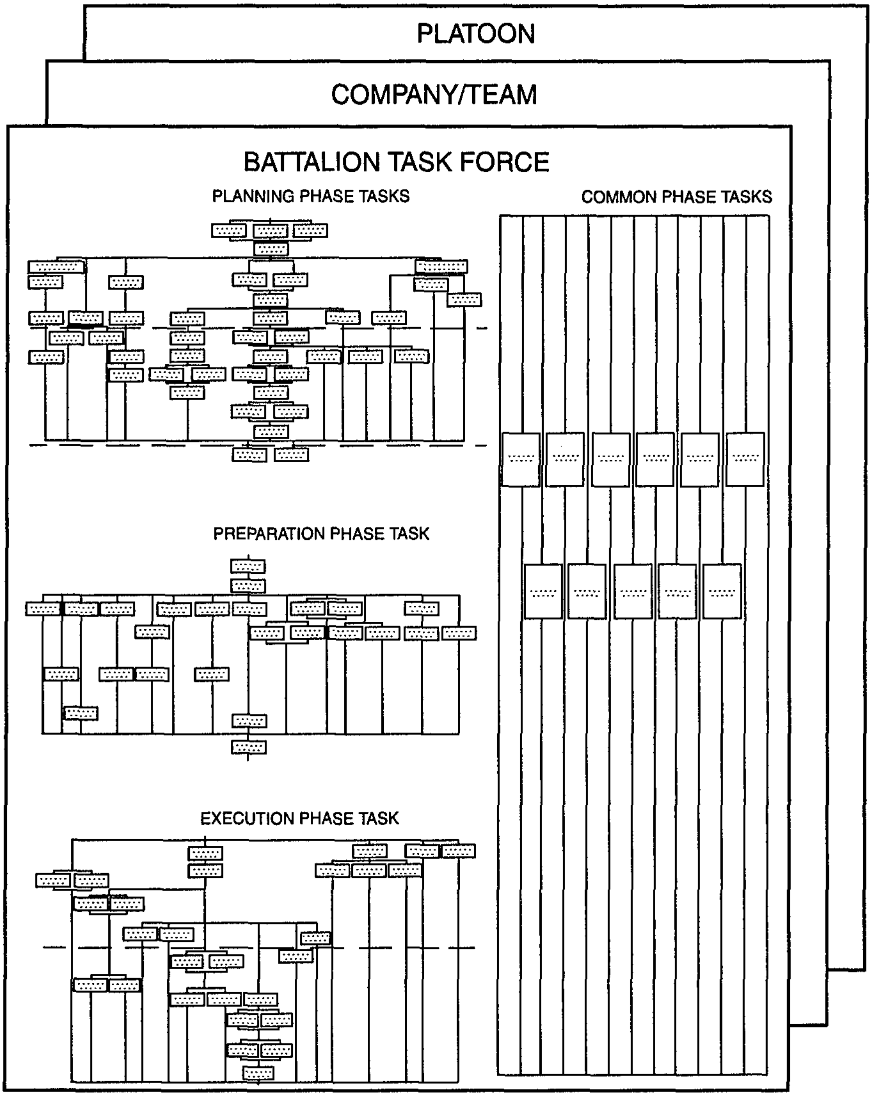
Second, the tasks did not follow one after the other. Their interactive nature made many of the activities concurrent and created dependencies between tasks. While the segment definitions facilitated the task organization process, the task sequencing layout soon appeared as an unconnected flow chart.

Task linkage. In order to demonstrate the interactive nature of the tasks as they progressed through a mission, logical connections were made between tasks. Some of these linkages were relatively obvious, as many of the outcome tasks in the planning phase were dependent on a previous process task. In cases where the placement of the task was unclear, the Troop Leading Steps and Military Decision Making Process served as a guide. Using these and other doctrinal material, a committee of SMEs developed a task linkage structure for all echelons and missions.

Utility

Because this framework for a unit performance measurement system mirrors the training feedback process used at all

Figure 3. Task analyses for Planning, Preparation, and Execution for a Battalion Task Force: An example.



the Combat Training Centers, it allows for a more comprehensive tactical analysis than other methodologies and can serve as a source training document.

As a research document, it affords the capability of examining, in detail, the tactical readiness of a unit through doctrinal field measurements as opposed to deriving the readiness level by examining structural, organizational, and discipline

factors. This, in turn, allows for more focused and specific studies and analysis than have been practical in the past. Many of these studies have already been conducted at ARI-POM and elsewhere. They have provided a myriad of data both back to the NTC cadre to support their training and to a wide variety of other Army commands and agencies.

As a training document, it provides an outline of the critical actions that must occur for mission accomplishment. While it may not reduce the scope of unit training activities, it is designed to reduce the magnitude and provide the commander with a list of the high-payoff training tasks on which to focus training. The Center for Army Lessons Learned located at Fort Leavenworth, Kansas, is currently in the process of publishing the products of this effort in the form of 15 Battle Tasks books. These documents describe the tasks, conditions, and standards for five mission types: Deliberate Attack (Day), Defend, Movement to Contact, Hasty Attack, and Deliberate Attack (Night) for the heavy maneuver platoons, company/team, and battalion task force. (See Lewman 1993.)

VIII. RESEARCH BEYOND UNIT PERFORMANCE MEASUREMENT SYSTEM

The mission-oriented analysis described above did much to increase our understanding of the interdependencies of tasks performed by units from the various branches as they were integrated into a combined arms task force.

Focusing on individual tasks performed, however, provides the training developer with overly fine-grained information regarding mission performance. Conversely, the aggregation of individual tasks at the BOS level yields an exceedingly macro-level amount of information regarding performance effectiveness which is not particularly useful in developing programs designed to facilitate training a unit to be able to perform its mission essential tasks. Accordingly, a level midway between these two was sought in order to provide sufficient information concerning unit performance without being overly burdensome (task level) or overly broad (BOS level). The solution was found in the use of the concept of Critical Combat Functions. A total of 39 Critical Combat Functions were identified which describe inter- and intra-BOS relationships at the tactical level. The

CCFs are compatible with the Blueprint of the Battlefield developed by TRADOC. CCFs are defined as

> *The integration of related participants and tasks that represent a source of combat power. The synchronization of critical combat functions provides maneuver commanders at any echelon with a definable outcome that materially affects the battle.*

The next step was to explore these Critical Combat Functions to see if it was feasible to develop a product that the Army could use to optimize its training by identifying the tasks which need to be taught and developing a descriptive training program that would permit these tasks to be taught while making the best use of the resources available. That research is now under way at ARI-POM in a project titled "Design and Development of a Model Training Strategy for a Battalion Combined Arms Task Force."

IX. THE DESIGN AND DEVELOPMENT OF A MODEL TRAINING STRATEGY FOR A BATTALION COMBINED ARMS TASK FORCE

Task Analyses

The first phase of the project consisted of a detailed examination by a team of Subject Matter Expert analysts, each with Army combined arms experience, of each of 24 CCFs selected as relevant to mechanized infantry and armor battalion task force operations.

Derived from an extensive search of Army doctrine, primarily field manuals, and mission training plans, as well as a study of Army Lessons Learned and interviews with National Training Center Observer/Controllers, the resulting task analyses were meant to be used by the analysts in designing the training strategy. The CCF task analyses are useful to trainers, training developers, and force designers because they identify principal participants; interaction with higher, lower, and adjacent headquarters; information required by the task force (TF) headquarters in order to accomplish the function as well as the information which the TF must produce so that others can perform their tasks; the interaction and relationship with other CCFs; necessary subordinate proficiencies; and relevant

lessons from the Center for Army Lessons Learned (CALL); as well as the tasks and subtasks. This level of detail seems necessary to efficiently plan training events based on the selection of modules focused on a specific training objective and audience, containing the ingredients necessary to train across BOSs and between echelons.

The Training Strategy

The task analyses have laid the groundwork for the design of a training strategy which will permit a commander to tailor combined arms training events in terms of scope and size, to address specific training deficiencies, to sustain proficiencies, and to train new members of his staff. The commander will have a useful tool to facilitate his appraisal of BOS relationships and the linkage of events to battlefield outcomes. He will have an easier way to diagnose the effect of actions and orders and to pinpoint the actions/events/individuals/processes that require more collective training. He will be able to attack these shortfalls by training separate pieces.

Training Assessment

There is a need for an assessment tool to facilitate and pinpoint diagnoses for the improvement/remediation of training. Intended outcomes will be used as selection criteria to isolate collective tasks which require attention, including deficiencies in critical supporting or enabling collective tasks performed by subordinate echelons or essential individuals of the task force.

Training Planning

The planning module of the training strategy will provide the parts necessary to plan combined arms training events that address the deficiencies identified in the commander's assessment. The module will be presented for use as a descriptive and not as a rigid prescription. The training goals for the events will be based on logical culminating points in a function or a group of functions. Events can address horizontal and/or vertical linkages; they can also address modular training of individual staff officers or sections who work together on a particular task, e.g., Battalion Intelligence Officer (S2), Battalion Operations Officer (S3), Fire Support Officer (FSO), Soldiers Manual (SM), Mission Training Plan (MTP) on the Decision Support Template. Design of training events will key on a desired out-

come and will encompass the training objective, the key participants, the critical information input required by the participants [to be used as cues], as well as standards for the output which they must produce. "Gates" based on MTP and SM task proficiencies will be used as a means to regulate participation by subordinate echelons or individuals in the training event until they are "good enough" to participate without detracting from the higher echelon's collective training. Similarly, "gates" will regulate progression to other events. Planning will also incorporate the concept of "crawl/walk/run."

The Future

The Critical Combat Functions provide a moderate level of aggregation between the very detailed tasks in the Mission Training Plans and the more global Battlefield Operations Systems; analysis of the functions results in a description of horizontal and vertical linkages across echelons, thereby specifying the functional dependencies which influence performance. The specification of principal participants, procedures, and information flows yields a mapping of communication and coordination requirements for effective performance.

Collective training based on training functions is a new approach to achieving and sustaining the requisite proficiency to meet the difficult challenge of coordinating and integrating the combined arms. If this research demonstrates its efficacy for making better use of shrinking resources available for training the combined arms, it will be extended to encompass the light as well as the heavy forces and to cover the echelons of brigade, division, and corps. It is feasible, too, to analyze the functions of the Special Operations Forces in an analogous manner.

The research into the Critical Combat Functions has great relevance to other ongoing initiatives. For example, the aforementioned description of horizontal and vertical linkages and the specification of functional dependencies at a reasonable level of detail provide a flexible and usable tool for assessing training—especially when programmed into the Army's Automated Collection System (ACS). These descriptions will also enable the design of a more realistic Semi-Automated Force (SAFOR).

Emphasis on joint operations suggests a need for research along such functional lines to identify the functional depen-

dencies between the commander, the staff, and the components of a Joint Task Force so as to permit training in operations other than war and the other forms of contingency operations, joint and combined, which are emerging as important in the aftermath of the Warsaw Pact's demise. Such research is not only feasible but desirable to plan not only joint training exercises, but also service training exercises. The research is necessary also for the development of joint doctrine and the design of simulations for use in training joint operations and interoperability.

Analysis of functions permits training developers to design training focused along horizontal lines on a function in an echelon and also to isolate vertical linkages along BOS lines through several echelons so as to train those relationships, e.g., from the Fire Support Team (FIST) at company level to the Fire Support Element at division level. When transposed to training a multinational force engaged in combat operations, the ability to isolate such a vertical linkage in a critical combat function would permit efficient training to overcome differences in doctrine, equipment, and level of training among the participating forces.

Measurement of Performance at the Joint Readiness Training Center: Tools of Assessment

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INTRODUCTION

Background

Accurate, valid, and reliable criterion measures are needed to assess unit performance. The Joint Readiness Training Center (JRTC) has many types of unit performance data which are available to the Army training community (Nichols, 1991). For purposes of criterion measurement, three primary sources of data from the JRTC were identified and examined in detail (Dyer, 1993; Fober, 1993; Salter, in press); the training and evaluation outlines (T&EOs), the take home packages (THPs), and the task force (TF) and rifle company after action reviews (AARs).

JRTC Data Sources

As a means of assessing performance, each of the data sources has both advantages and disadvantages for the researcher who is seeking assessment tools. The research process used to study each source is reported here. Both the procedures for analyzing performance and the shortcomings and strengths of each approach are included. The time frame covered included JRTC rotations from FY89 to FY93; the units were Light Infantry.

The T&EO data base was designed to match the standard Infantry Mission Training Plans (DA, ARTEP 7-20-MTP, 1988). The T&EO is a computerized data base of the Observer/Controllers' (O/Cs) ratings of MTP tasks, task standards, subtasks, and subtask standards. It was identified as the performance measurement system which would allow researchers to examine unit performance by task based on the research objectives.

For example, ten tasks were extracted from eight rotations to provide a view of command and control, primary staff functions, and related slice element performance assessments (Thompson et al., 1991).

The take home packages are comprehensive after-action reports, written and compiled by the O/Cs immediately after the rotation has been completed. The THPs include mission summaries, live-fire reports, battle damage assessments (equipment and personnel casualties), and reports on unit strengths, weaknesses ("areas in need of improvement"), and recommendations for home-station training. The THP is written specifically for the unit; it is provided in written form as a post-rotation reference document for assessing future training needs. Comments are specific to the unit, down to company and often to platoon level.

After action reviews are an integral part of all military field exercises. The JRTC AARs are given immediately after each mission, and at the end of the unit's rotation by the O/Cs. Videotape copies of these AARs are then provided to each unit. The AARs are for the brigade and battalion task force and for the rifle company and platoon. Functional area AARs are also given at the end of the rotation, e.g., combat service and combat service support operations, intelligence. All AARs cover the planning, preparation, and execution phases of each mission, and provide immediate recommendations to leaders on how to improve performance in the next JRTC mission.

An advantage of these three data sources is that they are primary, not secondary, sources of data. Therefore, they document firsthand information; they are direct records of events. However, this does not mean that the recorded information is necessarily accurate or complete. Selective perception, selective recall, and conscious or unconscious distortion of information can occur. The format and purpose of a data source can also influence the information recorded. In addition, given the complexity of JRTC rotations and limits on resources for data collection, complete documentation of every event at JRTC cannot be provided by either a single source or a combination of sources. Information is omitted; of necessity, the sources are selective.

TRAINING AND EVALUATION OUTLINES

The T&EO checklists were examined to determine if and how they could provide readily available, complete, accurate, and objective criterion measures for researchers. Thompson et al. (1991) questioned the quality and value of the T&EO performance measurement system based on the nature of the data examined. Fober (1993) uncovered additional problems with the data base in a more detailed examination of the T&EOs. Both studies are briefly summarized here as they relate to performance measurement issues. Based on the results of these studies briefed to JRTC personnel, ARI-recommended changes were made to the data collection instruments with the intent of reducing the previously identified problems. Preliminary findings regarding the effectiveness of these changes are presented.

Training and Evaluation Outline Format

The T&EO checklist consists of tasks, task standards, subtasks, and subtask standards developed for training. The T&EO tasks were derived from the Army's Mission Training Plans (MTPs) for the various echelons/slices. One benefit from using the T&EO checklist is that Infantry units are familiar with them. Units train to the T&EO standards under home-station conditions. At the JRTC, O/Cs fill out the T&EO checklists for the unit and echelon/slice that they observe. Another attractive aspect of the T&EOs is that they provide detailed information by task. By examining the T&EO checklist information on tasks performed under conditions at the JRTC, researchers may gain insights into home-station training methods that contribute to successful performance.

There are some potential drawbacks to using T&EOs as criterion measures. The T&EOs were developed as a training tool to aid units in training to standard. Therefore, the rating system was not set up as a performance measurement system. The tasks were rated on a scale of Trained, Needs Practice, and Untrained (TPU); task standards, subtasks, and subtask standards were rated on a scale of GO/NO GO and NA/did not observe. Although these scales can serve the purpose at home station, they may not offer enough discrimination to serve as training center criterion measures. Another drawback of using the T&EOs is the way that O/Cs rate them. Crumley (1989) noted that O/Cs in settings such as the JRTC typically com-

plete their ratings at the end of missions and not as the tasks are being observed. As a consequence, the data entries or ratings may very well be influenced by the overall outcome of the mission, i.e., halo error, rather than specific unit behaviors relevant to accomplishing an assigned task. Crumley (1989) has taken the position that an individual who has been tasked to observe and control simultaneously, such as O/Cs at JRTC, cannot effectively accomplish both duties at once. Discussions by the authors with O/Cs have revealed that they will accomplish assigned tasks according to established priorities and to the extent that they are trained and provided time to do so.

Battle Staff Research

During the examination of T&EO tasks from eight rotations, Thompson et al. (1991) identified some potential problems with the data base. Specifically, the review of the data could not always distinguish whether a task, or related subtask, was performed or if it was performed but not subsequently recorded by the observer. That is, it is not clear whether missing values in the data corresponded to tasks and subtasks rated or if they were attributable to absent ratings. A basic example will illustrate the point. A review of O/C responses revealed that "Did Not Observe" entries were used frequently when there were actually no corresponding subtasks available for comment. Similarly, under tasks considered trained or untrained, many supporting subtasks were left blank. These subtask performance records were often not designated as being critical to the assessment of the task performance. Based on this, Thompson et al. raised two basic questions regarding the quality and relative value of the subtasks and the quality and value of the performance measurement system for anything other than immediate feedback to the rotational unit.

Initial Detailed T&EO Analyses

The JRTC T&EO data base was examined in more detail by Fober (1993) to determine its utility for unit feedback and conducting trendline analyses. Company and platoon data from five FY90 unit rotations were analyzed as a test of the data base. Several problems arose that suggested limited utility of the data base as a criterion measure at that time. The major factors contributing to the data base problems were data entry

errors, errors of omission, and possible O/C biases. As a result of this research, several changes were made to the T&EO data collection instruments and procedures. The following section details some of the changes to the T&EOs as they relate to the past problems in using the T&EOs as criterion measurement.

Changes to T&EOs

Rationale for changes. The most obvious problems with the T&EOs were biases in the percentage of GOs given and the number of tasks rated by the O/Cs. These problems could have resulted from the T&EO rating scale itself. The T&EOs were developed for home-station training. Checking GO or NO GO beside each statement is useful at home station in determining what tasks have been performed to standard. However, as a performance measurement system, this type of scale leaves too much to the discretion of the individual O/Cs. That is, one O/C may interpret failure to perform every aspect of a subtask to standard as a NO GO, while another O/C may not. O/C workload may also contribute to the problem. Because the T&EO tasks are so detailed and the O/C workload is so high, there is a tendency to check NO GO or GO for whole pages at a time.

In addition, the GO/NO GO rating scale used for training did not discriminate differences in unit performance. In other words, the range of performance based on the T&EOs was not great enough to distinguish units that performed well from units that performed poorly. Thus, even if a variety of home-station training methods were noted, it would be difficult to determine which methods contributed to success.

Rating scale changes. A five-point rating scale was introduced using behaviorally anchored words. The words and definitions came directly from reviews of take home packages and discussions with O/Cs. The following is the rating scale:

1 – Poor	Unit completely lacked technical and tactical proficiency to perform this task to standard.
2 – Weak	Unit attempted to perform task but lacked technical and tactical proficiency to meet all standards.
3 – Adequate	Unit demonstrated technical and tactical proficiency required to perform task to standard.
4 – Good	Unit demonstrated technical and tactical proficiency to perform task and exceeded some standards.

5 – Excellent Unit demonstrated technical and tactical proficiency to perform task and exceeded most standards.

Other changes. Potential O/C workload was reduced by eliminating the requirement to rate task standards and subtask standards. With the new scale, O/Cs rate only subtasks and the overall tasks. Task standards and subtask standards are provided as reference only and are not rated.

T&EO tasks are provided to the JRTC O/Cs in a booklet known as the "greenbook." In the past, the greenbooks were given to the O/Cs at the beginning of the rotation. Greenbooks contained all possible tasks that could be performed at any time during the rotation by the echelon/slice observed. This practice led to problems in coding data by separate missions. Currently, the greenbooks are labeled and handed out for each mission. Therefore, the greenbooks contain only tasks relevant to the mission to be performed.

During the process of changing the T&EO measurement system at JRTC, researchers worked closely with O/Cs in developing a system that would be acceptable to them. It was the goal that O/Cs would view the system as a useful tool for researchers, thereby placing a higher priority on accurately filling out the greenbooks. Also, as a result of collaboration with JRTC O/Cs and other personnel, there is greater command emphasis on O/C ratings.

Preliminary Findings

This section presents preliminary results on the effects of the T&EO measurement system changes on T&EO data quality. It was expected that changes to the rating scale, reduction in task statements, and more frequent feedback to the O/Cs would impact positively on the utility of the T&EO data base as a criterion measure. The initial analysis was based on five FY90 JRTC rotations; the current analysis of the revised rating scale was based on three more recent (FY92 and FY93) JRTC rotations.

O/C rater bias problems. One of the initial problems with the T&EO data base was the tendency of some O/Cs to fill out a minimal number of tasks regardless of the element's mission. Table 1 contains data from eight rotations. Data from five rotations are provided using the old T&EO measurement system, and data from three rotations are provided using the changed

T&EO measurement system. With the old system, Z company was rated on the fewest number of tasks over five rotations. Fober (1993) concluded that this was a result of the Z company O/C failing to complete all of the performed tasks as opposed to the Z company missions being the same for five rotations. As can be seen from the three rotations under the changed T&EO measurement system, companies were rated on more tasks and trends by company across rotations do not appear.

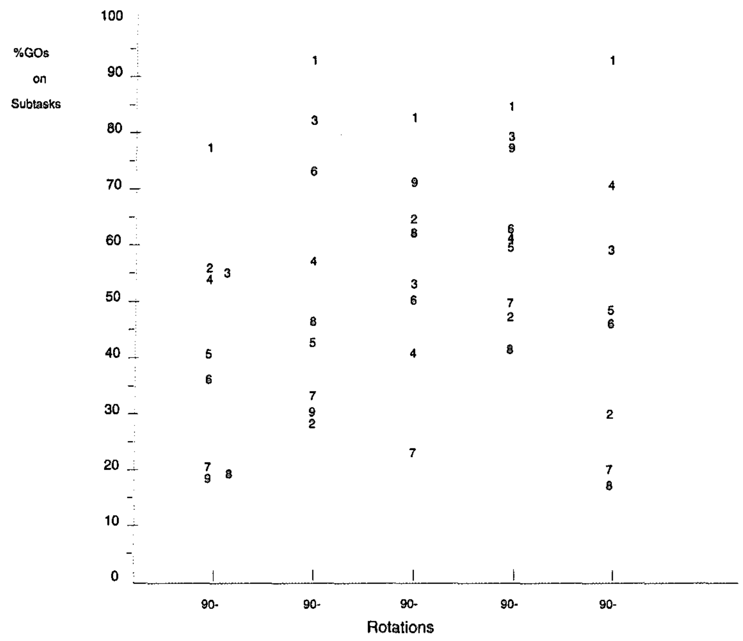
Table 1
Total Number of Tasks Rated by O/Cs for 24 Companies: Comparison of Old and New Greenbook Formats

Old Greenbook Format				New Greenbook Format			
	Companies				Companies		
Rotation	**X**	**Y**	**Z**	**Rotation**	**X**	**Y**	**Z**
1	15	14	7	6	16	17	12
2	12	15	7	7	17	21	13
3	14	15	6	8	17	21	21
4	15	14	6				
5	10	15	5				

Note: The rifle companies in Rotation 1 were randomly assigned the letters X, Y, or Z. This company designator was kept consistent across all rotations to identify possible O/C trends. Numbers do not include multiple iterations of the same task.

Another problem was an apparent bias in the percentage of GOs given by some O/Cs. Platoon data from the five rotations rated under the old format showed that Platoon 1 always received the greatest percentage of GOs (Figure 1). Platoon 7 was always near the bottom. In order to compare the changed T&EO system to the old format, ratings of "adequate" (meeting standards) and above were used as GOs for summarizing the results of the platoons rated with the new five-point scale. This transformation was successful from two perspectives as illustrated in Figure 1. First, the distribution of "GOs" across platoons and rotations was similar under both systems. Second, the tendency for individual O/Cs to restrict their ratings regardless of platoon performance was reduced with the new format; less O/C rater bias occurred.

Figure 1. Percent GOs on rifle platoon subtasks using the old and new greenbook formats. Each number represents a platoon.

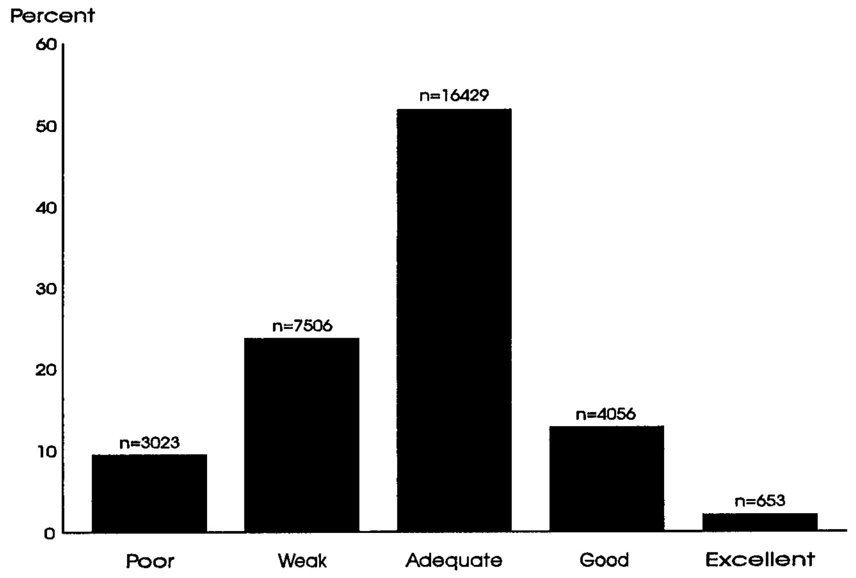


In summary, it appears that the changes made to the T&EO system have reduced the magnitude of O/C biases. The number of tasks rated to a company and the percentage of "GOs/Met Standard" assigned to a platoon were less likely to be a function of a particular O/C. Although three rotations is a small sample, the lack of a bias pattern with the changed format is encouraging. Reducing the subjectivity in the T&EO system makes it more attractive as a means of criterion measurement.

Does the Scale Discriminate?

All subtask ratings for the rotations under the new format are summarized in Figure 2. Although half the ratings are in the adequate category, O/Cs are using the full range of the scale. From the standpoint of criterion measurement, two questions emerge. Does the scale discriminate among units/elements, and does the scale discriminate among tasks? The answers to these questions are important if T&EOs can be useful tools to assess home-station training methods.

Figure 2. Subtask ratings for all echelons over three rotations.



Unit discrimination. One way to examine units is to obtain an overall mean of the subtask scores. Fober (1993) found that an overall score provided results similar to scores calculated by mission. However, because the data were found to be questionable, an overall score may not be the best way to discriminate units. This issue was reexamined with the recent FY92–93 rotations where the O/Cs used the new greenbook format. Overall subtask means were calculated for the three rifle companies in each of the three rotations; the means ranged from 2.3 to 2.8. Even without the benefit of statistical analysis, this range did not appear to be wide enough for unit discrimination, supporting the initial findings that an overall rifle company score is not sensitive to differences in unit performance.

Rifle company scores were then examined by task force mission and specific tasks within each mission to determine if this level of analysis would provide unit discrimination. Means on selected company tasks performed during the task force mission "Defend" are presented by company and rotation in Table 2. The range for the company means for the "Defend" mission was the same as the overall rotation means. However, the task means varied more widely across companies. For example,

task means for "Develop and Communicate a Plan" varied from 1.5 to 3.0. As more data become available, it appears that criterion measurements should be developed from tasks rated under specific missions rather than from an overall score.

Table 2
Subtask Means of Selected Tasks for Rifle Companies from the Task Force Mission "Defend"

		Rotations		
Company	**Tasks**	**1**	**2**	**3**
X	Mission	2.4	2.4	2.4
	Defend	2.0	2.0	2.2
	Dev/Comm Plan	1.9	2.6	2.4
	Perform Operations Security (OPSEC)	2.3	2.1	2.4
Y	Mission	2.3	2.4	2.5
	Defend	1.1	1.3	2.7
	Dev/Comm Plan	1.5	2.4	2.9
	Perform OPSEC	1.7	1.8	1.9
Z	Mission	2.8	2.4	2.4
	Defend	2.0	2.1	2.3
	Dev/Comm Plan	3.0	2.4	3.0
	Perform OPSEC	N/A	2.0	2.0

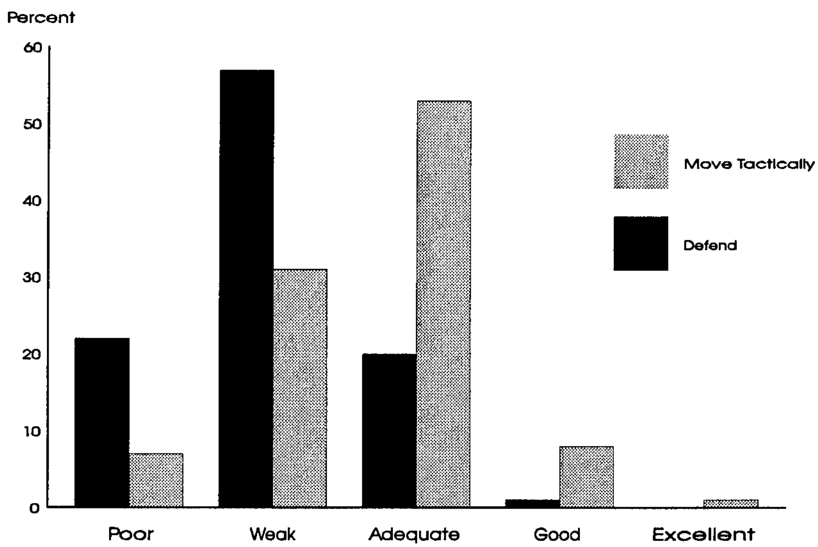
Note: Rifle companies were randomly assigned the letters X, Y, Z. This designator was kept constant across rotations. "N/A" data not available. Mission refers to a summary of all tasks for the task force mission "Defend."

Task discrimination. Company tasks were examined for the three rotations to determine whether the new five-point scale discriminated among tasks. Overall means of the task status are presented in Table 3. The means ranged from 1.9 to 2.8 with an average of 2.5. With only three rotations, statistical analyses may not be appropriate. However, the range of the means does appear to be sufficient to discriminate task performance. The distribution of subtask scores was examined for two tasks, Move Tactically (*M*=2.7) and Defend (*M*=2.0) and is presented in Figure 3. More than three-fourths of the subtask ratings for Defend were in the poor and weak categories compared to about 40% of the subtask ratings for Move Tactically.

Table 3
Means for Company Tasks
Based on the New Five-Point Rating Scale

Process Prisoners of War	2.8
Perform Logistical Support	2.8
Personnel Actions	2.7
Develop and Communicate a Plan	2.7
Infiltrate/Exfiltrate	2.7
Move Tactically	2.7
Conduct Actions on Contact	2.5
Maintain Operations Security	2.4
Assault	2.4
Employ Fire Support	2.3
Occupy Assembly Area	2.3
Occupy Hide Position	2.2
Defend	2.0
Linkup	1.9
Consolidate and Reorganize	1.9

Figure 3. Subtask ratings from two company tasks: "Move Tactically" and "Defend."



The T&EO data generated from the changed format provide some promise to researchers. Overall task means can be calculated to determine task strengths and weaknesses. A statistical criterion could be established that would select tasks exceeding a criterion as strengths and tasks below a criterion as weaknesses. Further analyses of the subtask distributions might lead to causes of and solutions for traditionally weak task performance.

Conclusions

Training research requires reliable, valid, and objective criterion data. The original system of using T&EOs at the JRTC fell far short of this requirement. Although there continue to be some shortcomings, the changed format offers some promise to researchers. The introduction of the five-point scale with behavioral definitions appears to have increased the reliability and objectivity of the data. Frequent feedback and collaboration with the O/Cs have also helped increase the objectivity of the data. Because T&EOs are used for training at home station, there is face validity to using them as a criterion measurement system. The process of developing a criterion measurement system is evolutionary. There should be constant assessment and refinement of the collection techniques to ensure that the system meets requirements. Using T&EOs as criterion measurement is still very early in the evolutionary process. However, it appears that the changed T&EO format at JRTC may be useful to researchers in the future.

TAKE HOME PACKAGES

This research (Salter, in press) was conducted to document the strengths and weaknesses of Light Infantry rifle companies at JRTC through analysis of the unit THPs and to generate an overall performance baseline for small units. The THPs are the most accessible and user-friendly feedback provided to units after JRTC rotations. Consequently, they are also designed to be a useful tool in planning for post-rotation home-station training. THPs would therefore also appear to be a useful tool for the researcher seeking information to link home-station training and subsequent training center performance.

Take Home Package Format

The THP is provided to the unit commander to provide a tool to assess the performance of the task force on its mission essential tasks. An overview of trends in each of the seven Battlefield Operating Systems (BOSs) is followed by a battalion review containing a task force mission summary, mission standards, and a narrative of the events which occurred during the mission. The company and specialty platoon sections follow task force level information.

The Infantry Rifle Company (the echelon studied here) typically conducts three or four missions, usually a movement to contact/search and attack, a deliberate attack, and a defense. Within each company THP, there is a summary of each mission, followed by the company's strengths, areas in need of improvement, and personnel casualties. Some THPs also offer separate sections on leader and individual skills. All include suggestions for home-station training. (The THP format was revised shortly after this research was performed. The new issue-oriented and standardized format, although similar to that described here, resolves some of the problem areas documented below.)

Forty-five company-level THPs from 15 Infantry battalions were examined. As would be expected, there were performance differences between the battalions, but overall their strengths, and particularly their weaknesses, were sufficiently similar to justify the decision to combine them for analysis. Overall performance trends were evident, and differences in performance between units and within and between battalions were easily discernible.

Content Analysis of THPs

Since the THPs varied in format as well as in content, a coding scheme or framework for content analysis of the THP material was developed to attempt to describe each unit's performance on a common scale. The compiled material, frequently overlapping or redundant, was reordered and reformatted into a usable form so that company performance (as assessed by the content of the THPs) could be compared for multiple different rotations. Despite the apparent difficulty in reading and coding each THP for the present research, a check-

list format presented the most workable standard format to accomplish this end.

Checklist development. The first step in codifying THPs was to develop a task list to describe the THP material. The intent was to find task and subtask labels which would fully represent the THP contents. Various training and doctrinal materials provided the basic framework for the material to be included. A list was developed to try to incorporate all of the relevant material in a form that was both user-friendly and sufficiently succinct to be useful.

To ease comprehension and minimize redundancy, the task list was roughly sequenced by categories reflecting the three phases of planning, preparation, and execution. It was further divided by mission, BOS, and by leader versus soldier skills. Some complex areas were further divided. The final list consisted of tasks and subtasks related to Light Infantry operations. The checklist was constructed to permit assignment of either positive or negative values (or both) to the various tasks and subtasks described.

Coding procedures. There was a need to eliminate the effects of different O/Cs (areas of interest, expertise, and writing style) and to accommodate the different numbers of missions and the impact of a particularly bad (or good) performance. It was therefore determined that each company in each battalion would receive only one positive check (strengths) or one negative check (areas in need of improvement) for any particular rated task or subtask.

Differing amounts of information were available for each battalion depending on when its rotation to JRTC occurred. Early rotation THPs covered all missions together in the comments; later THPs evaluated each mission separately. The selected means of tabulation of task and subtasks and use of a single scheme for all battalions permitted comparisons with the greatest amount of standardization, although the procedure produced some loss of data on specific unit or mission performance from the later rotations.

Home-station training recommendations were detailed at the end of each company's section of the THP. They typically covered broad categories of performance. Checklist items which corresponded to each of the recommendations were marked ac-

cordingly. Additional areas which did not appear on the checklist were also tallied.

The checklist was tested for inter- and intra-rater reliability and then edited to eliminate problem areas. An early finding was that experience and familiarity with relevant military terminology is required to provide reliable interpretation of THP content. This is a recurrent concern in THP analysis.

Findings

After all THPs had been coded, summary checklists were made. Although some of the battalions appeared to perform better than others, their individual and collective performances, as provided by the THPs, showed markedly similar patterns, and individual company performance was easily documented.

Some tasks and subtasks on the summary checklist had very few marks recorded for any company; other categories received many comments. Both the positive and negative comments were summed separately and percentages calculated. Looking at the distribution of comments overall, it is apparent that for every Take Home Package, many fewer strengths were cited than areas in need of improvement.

Every THP offers some positive comments about the strengths of each company. The favorable comments tend to be rather unstructured and frequently counterbalanced by strong comments indicating that performance on the particular task cited was also in need of improvement. The tendency for a company to be both praised and faulted in the same performance category occurred throughout the THPs. Sometimes the performance varied within the same missions; other times it varied from one mission to another.

Most comments in the company THPs were negative in both tone and content, despite occasional performance successes. Some weak areas comprised leader skills, others individual; most referred to the performance of the entire unit. Problem areas which surfaced during one mission tended to recur in others. Through THP analysis, the relative strengths and areas in need of improvement of Infantry battalions at JRTC are not only readily apparent but fairly consistent within and between battalions.

Take Home Packages as a Basis for Analysis

The original intent in analysis of the THPs was to compare them across missions and across battalions, to document strengths and weaknesses, and to provide baseline information on Light Infantry performance at JRTC. This was seen as a foundation for future research into Light Infantry performance. Several unforeseen problems made this more difficult than initially anticipated.

Subjectivity. THPs are highly detailed written narratives over which the researcher has no control. Content is not inclusive, but is highly selective. It is based on a format which is determined long before a specific unit's rotation, yet one that changes over time. The THP is based on items the O/Cs consider important, and other critical material and information may be omitted. Additionally, the contents are presented in a way that is most useful as unit feedback. Rather than a statistical record of unit performance, the THP is more nearly a subjective personal communication, open to nuances of interpretation.

Content. Each THP contains a great deal of information, the specific content of which is determined by the unit's actual missions and the O/Cs' perceptions of unit performance during those missions. Units which have done exceptionally well receive many comments under "unit strengths," although each company appears to get at least a minimum number of positive comments. Similarly, units with relatively poor performance receive considerable comment in "areas in need of improvement." However, there is little consistency between (or even within) THPs on the actual volume of material, the ordering of comments, or even the method of presentation of the strengths and weaknesses.

Additionally, although each THP cites both strong and weak performance areas, some tasks or subtasks are not mentioned at all. These tasks may not have been observed, omission may have been an oversight, or the execution may have been neither exceptionally good nor exceptionally poor, and therefore not included in the feedback package. Although many units improve during the rotation and learn from earlier mistakes, the THPs seldom reflect this and continue to stress deficiencies. Also, most THP comments tend to focus on planning and preparation issues, rather than on mission execution. This

may provide a distorted picture of performance, highlighting leader skills and individual tasks rather than collective mission performance.

Specific problem areas included redundancy and repetition within THPs, different reporting formats, and variations in the numbers and kinds of missions conducted. Units did not have the same kinds or number of missions, and even when the missions might be considered comparable, they did not occur in the same sequence. These findings made comparisons difficult, as some apparent performance deficiencies may have been due to time or sequencing within the rotation.

Formats. Comparisons of units is made more difficult by the evolution in THP formats which has been occurring over time. In early THPs, variations on one type of format were used to describe the company critical mission tasks, mission summaries, unit strengths, and areas in need of improvement. More recently, a different format has been followed and a much better picture is gained of the unit's mission performance as distinct from the leader's performance, and of potential differences between, for example, ability to plan for the defense and plan for the attack. The THP format is again in the process of change, and future THPs will undoubtedly have improved methods of providing unit feedback.

Missions. Although most THPs reflect similar missions, there were instances where, for example, a unit performed two attack missions but no defense; or in addition to the typical attack, defense, and search and attack, executed a second search and attack mission. Additionally, one of a battalion's companies may have been attached to another unit and may not have been a participant to the same degree as the others within the company. In a similar vein, some units performed air assault, or a specific civil and military operations mission; those that did cannot be readily compared with those that did not. One battalion did not execute a defense but performed several attacks. They had more chances to excel at, or fail at, offensive operations.

In view of the fatigue which may tend to overcome most units toward the end of their JRTC rotations, the order of presentation of the mission may also influence the apparent and real performance. Later missions may offer chances for improvement and remediation of errors, or better execution of the

planning process, but subsequent missions can be complicated by cumulative fatigue, which may be reflected in deteriorating performance. Loss of key leaders that carries over from one mission to another may also, as in combat, have a detrimental effect on mission performance.

O/Cs. The O/Cs who perform the assessments and write the THPs are as objective as possible, using standard references and measurements. However, each O/C's background and particular areas of interest and expertise influence the selection of items cited and the ways in which they are reported. This may provide misleading patterns in the THPs as they reflect each O/C's style. It may also lead to tendencies toward or consistencies in omissions. An example of this became apparent as the THPs were being coded. In seven companies, planning for and the use of smoke were recommended for further training at home station. However, all seven recommendations were made by the same O/C; no others mentioned these points. Similar patterns of individual O/C emphasis are apparent elsewhere.

Home-station training. The final portion of each THP covers O/C recommendations for home-station training. It was originally felt that these recommendations would be useful in comparing unit performance, but for several reasons these recommendations may be of limited use in describing company performance. With a few exceptions, there was a tendency to boilerplate this section, and many THPs had nearly identical wording. Recommendations were repeated, nearly verbatim, from one THP to another, with no regard for the actual performance. Some areas most in need of improvement were rarely highlighted. Some recommendations were only loosely tied to the preceding comments.

These findings tend to reduce the face validity of looking at training recommendations as performance discriminators between battalions. The information cannot, however, be discounted, as it correctly focuses on perceived weaknesses and provides good suggestions for improving training. Some recommendations were frequently used as catchall suggestions to cover a wide variety of generic training recommendations (do "force-on-force multi-echelon training," "conduct after action reviews at all levels").

Conclusions

THP content analysis highlights areas in need of improvement in each BOS and every mission at echelons from platoon to Task Force. Performance is scrutinized in the greatest detail in this material, and areas found deficient are highlighted to permit remediation and improved performance. A battalion very quickly learns its strengths and weaknesses; this provides the opportunity for change. The shortfalls, deficiencies, and outright failures in performance evident in the companies studied here reflect Light Infantry problems described by others, and are little different from shortfalls identified at the National Training Center. The areas of strength observed at JRTC are few and inconsistent.

The THPs, while imperfect, provide valuable feedback for the unit and the researcher alike. The newly developed and implemented Standardized Take Home Package (STHP), to be used at all the combat training centers, will provide better organized and more concise material in a standard form, which will not only increase the utility of the THP for the performing unit as a guide to home-station training, but will permit easier comparisons for researchers. The issue-oriented observation and reference format of the new Take Home Package will provide increased opportunities and capability for performance assessment.

AFTER ACTION REVIEWS

The AARs were examined to identify the unique information they contribute to assessing unit performance and also to determine their consistency with the THPs and the T&EOs (Dyer, 1993). Four areas were examined: task force and enemy missions and organizations, battle damage assessment, rifle company performance, and critical incidents and other factors affecting mission performance. Although quantitative data are presented in the AARs, their primary value as an assessment tool was viewed as qualitative in nature, providing the necessary context and background for interpreting "harder" data available in the T&EOs and the THPs.

After Action Review Format

Task Force After Action Reviews. The Task Force (TF) AARs are conducted by the senior O/C. Videotapes of each AAR and a paper copy of the slides used during the AAR are made. These AARs are usually 2 hours and 30 minutes in length.

The typical AAR format is as follows. First, a short summary of the mission is given. This is followed by information on the enemy's mission and organization, the brigade mission and brigade commander's intent, the task force mission and task force commander's intent, and the task force organization. The senior O/C then asks task force personnel in key duty positions to identify the aspects of performance which they want to sustain based on the mission just completed. Areas which need to be improved are also identified.

Mission planning and preparation in key functional areas is reviewed next. Each BOS is covered in this process. The areas typically examined in detail are intelligence support; fire support; the S-3's plan; air defense; close air support; engineers; command, control, and communications; and combat service support. Discussions on the impact of these areas on the mission are documented only in the video AAR.

The other major part of the AAR is mission execution. The TF commander describes this phase, including the scheme of maneuver and integration of assets. All assets critical to the mission are discussed (e.g., aviation support, scouts, engineers). The company commanders describe mission execution from their perspective. Lessons learned and factors to consider in future missions are stressed.

The leader of the opposing force briefs his organization on mission planning, preparation, and execution. He describes the strengths and weaknesses of the rotating unit. In addition, in the final TF mission AAR, all intelligence information collected by the opposing force on the unit during the rotation is described.

Key events, their sequence, and exact times are presented. Battle damage statistics are reviewed. Slides identifying major strengths and weaknesses in leader and individual skills and in the planning, preparation, and execution phases are presented. The final AAR concludes with summary statements by the commander, JRTC.

Company After Action Reviews. The Company AARs, typically 1 hour and 45 minutes in length, are conducted in the field by the company O/C. A videotape of each Company AAR is made. No paper records are retained, although O/Cs typically use poster boards and graphics to illustrate points.

The Company AARs are less structured than the TF AARs, being primarily discussion and learning sessions. The format varies with the O/C. In addition, the sequence of topics and the specific topics discussed vary, depending upon the mission results and the training points the O/C has determined as critical. However, the AARs do cover the planning, preparation, and execution phases of each mission. In addition, a leader from the opposing force describes the enemy situation and comments on strengths and weaknesses of the rotating unit. Exchange of information between the O/C and unit leaders occurs throughout the AAR.

Method

Sample. Complete TF and Company AARs were obtained on two FY90 rotations to JRTC. Both rotations were Light Infantry, active Army units. The missions common to both units were Defend, Search and Attack, and Deliberate/Infiltration Attack. AARs conducted for such elements as close air support and combat service support were not examined in the analysis. When possible, comparative analyses were conducted on the same units using the THPs and/or the T&EOs. However, because of the missing data and errors in the T&EO data base for these two rotations, very little T&EO information could be used.

Analysis. The TF and Company AARs for each mission were examined, a total of 7 TF AARs and 20 Company AARs. Only one Company AAR was not available. Platoon AARs were not analyzed.

For both the TF and Company AARs, a written transcript was made of the audio portion of the tape. When possible, the duty position of the person speaking was recorded as well. Graphics and other data were copied from the tape when the paper copy was not available or the paper copy was illegible. Coding procedures were developed for content analysis purposes.

Findings

Mission summaries and force organizations. Summary information on the task force and enemy missions included an overview of the task force and the company missions, the task force commander's concept of the mission, how major elements were deployed, and major events affecting the mission (e.g., weather, failure to complete critical tasks, key leader casualties, timeliness of close air support). Main actions by the enemy (e.g., intelligence gathered, fire support, type and amount of contact with the task force) were also described.

Both the task force and enemy organizations were documented in the TF AAR. However, the task force organization was typically in the video AAR only. Because the task force organization can influence the mission, this information must be considered when interpreting unit performance. Rarely were rifle companies employed pure; cross-attachments occurred frequently; platoons were sometimes under battalion control. Similarly, the anti-tank platoon, scouts, and/or engineers could be attached to a rifle company, or they could be under battalion control.

TF battle damage assessment. Personnel casualties, equipment losses, and fire support data for each mission were reported in the TF AAR. Personnel casualties were described in terms of starting strength, number killed, number wounded, number who died of wounds, number of fratricides, and number captured. A further breakdown of these numbers by task force element was presented. Rifle company casualties were also given at the completion of most Company AARs. Killer-victim score boards for both the task force and the enemy were presented.

Fire support data in the TF AAR included a fire support matrix showing the number of missions fired by each fire support system (e.g., mortars, artillery, close air support, naval gun fire, attack helicopter). Also shown were the casualties, fratricides, and equipment losses attributed to each fire support system, and the total ammunition expended. A similar matrix was given for enemy fire support. Finally, the percentage of fire missions judged to be effective for the mission under review and a cumulative percentage for all missions to that point in the rotation were cited.

Battle damage statistics are of great interest to many researchers. However, concluding that unit performance is good or bad based on casualty or system effectiveness numbers greatly oversimplifies the situation and does not lead to appropriate home-station training recommendations. A variety of factors can yield the same battle damage but can require quite different home-station training strategies to improve performance. The AARs are excellent sources for determining possible causes of problems and likely training solutions.

A good illustration of how content analysis of the AARs can be used to place battle damage statistics in the proper context is fire support. As reported in the TF AARs, fire support missions may not have been executed because of communication problems, tactical operation center (TOC) casualties, indirect fire crew casualties, limited number of rounds, and/or an inability of aviation to fly because of the weather. Missions, once executed, may not have been effective because of communication delays, a poor fire support matrix, failure to get eyes on the objective to adjust rounds and/or modify the fire support plan, and/or poor individual skills on the part of the crews. Despite the importance of this information, considerable study of the AARs is required to determine the constellation of factors at work within a specific rotation and/or whether systemic problems exist across many units.

Squad and platoon assessments. Rifle squad and platoon casualty data were found only in the TF AAR. A squad status chart cited the starting and end strengths of each squad by platoon, company, and mission. With ground troops, a critical factor affecting casualty rates is the degree of enemy contact. It was determined that the Company AARs could be used to document the degree of enemy contact at the platoon level and to adjust performance baseline results as required.

The location of each platoon and whether it had enemy contact were determined from the Company AARs. Specifically, platoons were coded as either having substantial contact or as having minimal or no contact. No contact included situations where the platoon was bypassed by the enemy or was the TF reserve element and saw little action. Minimal contact included incidents of silent kills at night, booby traps, and a few indirect fire casualties. Substantial contact occurred when the platoon encountered the main body, had repeated contacts with the

same enemy element, or had contact with several enemy elements throughout the mission. Considering all missions, the degree of enemy contact could be determined from the Company AARs for 92% of the platoons.

Platoon casualty rates were then examined as a function of mission and degree of enemy contact. The results showed clearly how average casualty rates can be misleading when factors such as degree of enemy contact are not considered. For example, the average casualty rate for the Search and Attack mission was 41%. However, for platoons with substantial contact it was 63%, and for platoons with minimal or no contact it was 3%.

In summary, the squad status chart in the TF AAR provides valuable data. However, these data should not be used in isolation to discriminate "effective" from "ineffective" platoons or squads. The analysis showed that it was both necessary and possible to integrate information from the Company AARs to help account for the casualties.

Rifle company tasks. The Company AARs were examined to determine if they were a good source of tasks performed at the company level. A content analysis of tasks reviewed in the Company AARs was conducted using the master list of tasks in the T&EO data base. Only tasks explicitly discussed were included in the analysis. Tasks which might have been performed, such as consolidation and reorganization or operations security (OPSEC), but were not discussed, were not included. Inter-rater reliability indices on task category coding process were computed.

To compare tasks from the AARs with those in the THPs and T&EOs, the same coding scheme was applied to the THPs; the company tasks in the T&EO data base were identified electronically. There was commonality in the tasks cited in these three sources, with the overlap in tasks typically ranging between 40% and 80%.

The analysis showed that identifying tasks from an AAR is a lengthy process and will typically yield an incomplete list. Creating a transcript of the audio AAR is the most time-consuming step; then this information must be coded. Errors of omission are common, as there is no requirement for the O/C to review all company tasks during an AAR.

Rifle company performance. The original intent was to establish a reliable company performance baseline by consolidating company performance strengths and weaknesses as reflected in each data source. However, the information on company performance in the TF AAR audio tapes could not be used, because they focused heavily on execution, very little on planning and preparation.

The Company AARs were also excluded because they did not lend themselves to determining strengths and weaknesses. The Company AAR is a training vehicle. The O/Cs rarely made evaluative judgments such as "Only 50% of the defensive positions were prepared to standard" or "No observation posts (OPs) or listening posts (LPs) were established." Instead, the emphasis was on describing what happened, trying to determine why it happened, determining possible improvements, and determining each leader's understanding of the mission and his responsibilities. Given the question-asking, nonevaluative dialogue between the O/C and the company leaders, it was deemed inappropriate to use the Company AARs to identify positive and negative aspects of performance.

However, the TF AARs did contain summary slides on company strengths and weaknesses (areas in need of improvement) which could be used to generate a company performance baseline for each mission. Four domains, encompassing 26 specific areas, were covered: Leadership and Individual Soldier Skills, Combat Planning Subtasks, Combat Preparation Subtasks, and Combat Execution Subtasks. A brief evaluative statement was typically made about each company (Make a Tentative Plan: "Courses of actions incomplete—Company X; Poor METT-T analysis—Company Y; Planning improved from previous mission—Company Z"). These statements can be tabulated to provide a very quick assessment of company performance. Given the brevity of the TF AAR summary slides on company performance, however, they should not be the primary source for assessing company performance.

When comments from the AARs and THPs were made on the same topic, they typically agreed. A comparative analysis is one way of identifying the most critical performance areas for mission success and whether companies are typically strong or weak in those areas. Problems arise when the area of interest narrows—being mission specific, condition dependent, or sys-

tem unique—and where comments may not exist in each source. All sources are important to examine in such instances.

Critical incidents. A major challenge is to depict the dynamics of the battles at JRTC; to describe the impact which events or processes have upon the mission; to put the events in the appropriate context. Such descriptions should go beyond statistical summaries of battle damage; expand upon executive summaries focusing on task force level events; and supplement lists of unit, leader, and soldier strengths and weaknesses. For example, the Company AARs are the primary means of determining the primary and secondary missions of each company, where the companies and platoons were located on the battlefield, their eventual role in the battle, and their impact upon the mission. To thoroughly understand the dynamics of each mission, the AARs must be examined.

To summarize the AAR information, a critical incident chart was generated which showed, in sequence, the influential or decisive events for the task force and each company. Information for this chart came from the TF and Company AARs. However, the starting point was the key events slides in the paper copy of the TF AAR. These key events slides were presented for the task force, each company, and at times for other task force elements (AT and/or scout platoons). They indicated the exact date-time-group when critical events occurred (e.g., orders, initiation of movement, casualties, indirect fire missions), as well as casualty figures.

To generate a critical incident chart for a mission, the essential information on the key events slides was integrated in a single two-dimensional (time by TF element) chart. Time within each 24-hour period was divided into four 6-hour segments. Not all information on the slides was included. For example, casualty figures were omitted because not all casualties were accounted for on the slides. The key events data were then supplemented by explanatory and/or additional critical information from the transcripts of the TF and Company AARs. The final determination of chart content was subjective, considering all information in the TF and Company AARs.

The analysis showed that relying only on the key events slides in the TF AAR was insufficient for depicting battle dynamics. The key events slides had to be supplemented with four types of information. First, when the company key events

slides differed in detail in the TF AAR, information from the Company AARs was added to present a balanced picture of company actions. Second, information on the impact of an event was included in the critical incident chart. The key events slides typically cited only the event and not its consequence, except for casualty data. Third, information on intelligence information possessed by the enemy, the weather, and availability of special assets (e.g., enemy air) was added. These factors were perceived to be critical in understanding the mission outcome and were usually not cited on the key events slides. Fourth, factors which affected battle dynamics throughout the mission (lack of security, communication problems) were added. Again, these were not typically listed as events on the TF AAR slides.

The critical incident chart proved to be a good method for understanding and depicting the battle and the cumulative effects of events on mission outcome. Because the AARs progress from the planning to the execution phase, they provide the sequential data and links between events often absent in the other feedback sources.

Conclusions

In addition to providing unit leaders immediate and constructive performance feedback, the AARs provide other users the needed, but often lacking, context for interpreting the "hard data" available on JRTC rotations. The TF AAR gives the analyst an excellent understanding of each mission, battle dynamics, and task force planning, preparation, and execution. The Company AAR accomplishes the same purpose at the company level. These reviews can be conducted relatively quickly. Certainly, battalion staff preparing for a JRTC rotation would benefit from reviewing previous TF AARs; company leaders, from company AARs; and platoon leaders, from platoon AARs. Reviewing a series of AARs could be a very powerful instructional tool for unit leaders.

For the researcher, performance assessment data can be obtained most easily from the TF AAR (paper copy of slides). However, more intensive study is required for complete documentation of unit performance and to identify the unique and critical events which impact mission outcome. This in-depth

analysis is a very time-consuming, yet critical, process if performance assessments are to be sound.

SUMMARY

As shown here, the THPs, AARs, and T&EOs have different purposes and formats, and therefore require different analytic approaches. All the assessment tools have good and bad points. Each contains unique information; no source is a complete record of unit performance.

The sources differ also in the extent to which they are user-friendly. On the one hand, the THPs can be read easily, and a researcher can skim sections not immediately relevant. In contrast, the T&EOs require data base and statistical expertise. The typical AAR must be heard in its entirety since it is impossible to know the exact times when specific topics will be discussed.

The AARs allow the user to "experience" each mission; to understand the dynamics of the battle from O/C, enemy, and task force perspectives; to learn the strong and weak points stressed by the O/Cs immediately upon mission completion. The THPs provide a wealth of information on each Battlefield Operating System and each mission; performance feedback is documented systematically and in detail for later use by the participating unit. The T&EOs are the most highly structured source of information, providing numerical summaries of unit performance for all task force elements from the battalion down to the platoon and section.

Individual interests and needs will determine which source to use. All have merit; none is best overall.

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SECTION II

Determinants of Effective Unit Performance

The papers in this section focus on identifying those training practices, procedures, and techniques that can have a significant impact on performance outcomes. All of the papers use the performance of units at Combat Training Centers as the criterion source. These papers convey findings that unit leaders and resource managers should find helpful for organizing, resourcing, and conducting unit training.

The first paper by Hiller, McFann, and Lehowicz reports the first successful effort to link resource allocations provided to units during training at home station to subsequent performance effectiveness at the NTC. This work formed the basis for the subsequent expanded research on home-station determinants of unit performance reported in the following four papers.

The second paper by Holz, O'Mara, and Keesling provides an overview of the home-station determinants research as carried out on armor and mechanized infantry units that conducted training at the NTC and describes the research design, methodology, sample, and overall findings.

The third paper by Keesling, O'Mara, and Colonel (Ret.) Flanigan describes the findings from the determinants research in terms of the training management principles as described in FM 25-100 and can be considered to be an analysis of unit practices with respect to that guidance.

The fourth paper by Keesling, Ford, and Colonel (Ret.) Harrison examines the home-station training practices, to include OPTEMPO allocations, found to exist among and between units, and subsequent performance as assessed at the NTC.

As the papers in this section indicate, the effective performance of Army units at the NTC was explained in large part by the amount of training resources these units were allocated

at home station prior to conducting rigorous training at the NTC. Secondly, the performance effectiveness of units at the NTC was found to be predictive to the extent that these same units followed existing Army doctrine published in FM 25-100, Principles of Training.

The first four papers clearly indicate that unit performance outcomes during the conduct of rigorous and stressful training are both measurable and predictable. These papers provide clear and convincing quantitative evidence that performance effectiveness—that is, unit training readiness—could be damaged by reductions in OPTEMPO, as well as by units' failing to follow training doctrine.

The last paper by Thompson, Pleban, and Valentine on battle staff training clearly indicates that battle outcomes are frequently determined by the effectiveness of staff operations. The paper presents research findings from a series of efforts which indicate the essential role of battle staff performance to mission outcomes.

Does OPTEMPO Increase Unit Readiness?[1]

Jack H. Hiller,
Howard McFann, and
Major General Lawrence Lehowicz

The purpose of this research was to design and test an operationally practical methodology for determining if level of OPTEMPO relates to objectively measured unit performance capability. The hypothesized relationship between military resources expended in field training by units and objectively measured gains achieved in their "training readiness" for combat is a venerable issue for the Congress, the Department of Defense, and its military departments. The issue has become critical while large Federal budget deficits continue and the threat of a major war appears to be diminishing. A direct linkage between training time/activity and reasonably objective ratings of proficiency has in fact been demonstrated to some extent for

- Navy aircraft flying hours with performance measured by bombing accuracy and landing success rate (DePoy, 1984; and Horowitz, et al., 1987);
- Air Force pilot bombing accuracy (Cedel and Fuchs, 1986).

However, the Army has traditionally assessed the training readiness or proficiency of its ground forces by having unit commanders subjectively rate their unit's capabilities and estimate the additional training necessary to be prepared for combat. The use of subjective estimation to establish the proficiency of ground forces derives from three major measurement difficulties:

The multitude of missions and tasks. No single, or even a few, unit tasks can be selected as a focus for objective measurement; instead there are tens of complicated missions (e.g., Deliberate Attack, day or night; Defend in Sector; and Movement to Contact) involving hundreds of tasks performed at numerous echelons from infantry fire teams and squads through platoon, company, battalion, brigade, division, and possibly corps and theater army. There is so much to measure

that experienced military judgment has provided the only practical basis for estimating unit capability and training needs.

The uniqueness of each unit and its post. Whatever unit performance might be selected for measurement, for the measures to apply to routine operational training (instead of a grand experiment that might be arranged and thereby fail to represent normal unit training and proficiency), they would have to be implemented at each unit's home-station training grounds. Since the terrain varies significantly from one Army post to another and the units often have distinctly different missions, and since the use of opposing forces to create realism is highly variable at each post and no posts have the instrumentation required to support an objective, standardized measurement system, standardized unit performance data could not be collected without a major investment that would likely fail to overcome the inherent differences across posts.

Difficulty of measuring leadership and cohesion. The intangible qualities of leadership and unit cohesion that are critical to combat are not directly, easily measurable by unit outsiders, but must be assessed within the units on a subjective basis.

Despite these measurement difficulties, the Army was challenged to demonstrate with objective measures of unit performance, instead of expert judgment as traditionally used, that the level of expenditures for operating heavy equipment during training (i.e., Ground Operating Tempo, or OPTEMPO) relates to combat effectiveness.

Solution Requirements and Constraints

The Assistant Secretary of Defense for Force Management and Personnel requested the Army to provide a plan for justifying the value of OPTEMPO within a few months and the results within a year's time. Statistical requirements for a representative sample of heavy units and repeated performance measures of each sampled unit, to provide a reliable assessment of capability, obviously conflicted with the requirement to produce results quickly and a practical need to avoid interfering with unit training schedules to perform an experiment.

The National Training Center, Fort Irwin, California, provides the most advanced, realistic simulated combat training for heavy forces in the free world. A critical feature of the NTC

is its instrumentation, which tracks the position of friendly (BLUFOR) and opposing force (OPFOR) weapon systems and records time-tagged vehicle hits and kills based on the use of the Multiple Integrated Laser Engagement System (MILES), which substitutes laser beams for munitions. The NTC provides training on a core set of missions on essentially the same terrain with an OPFOR that is reliable and effective. The Army Research Institute maintains a comprehensive Combat Training Centers research archive for all of the simulated NTC battles at its Presidio of Monterey Field Unit. The availability of this extensive data base for heavy unit training conducted at the NTC provided the basis for a solution.

METHOD

Criterion Variable

The performance effectiveness of heavy units (specifically the battalion task forces composed of mechanized infantry and armor units) was conceptualized as having three principal dimensions:

- Attrition of enemy forces (OPFOR);
- Survival of friendly forces (BLUFOR);
- Control of terrain.

The data were available in the CTC research archive for determining OPFOR attrition and friendly force survival (for instrumented weapons systems, principally tanks and armored personnel carriers), but objective determination of terrain control at the declared end of a battle was problematical. Therefore, the criterion performance variable was constructed as a traditional casualty exchange ratio (CXR):

$$\text{CXR} = \frac{\text{Total OPFOR vehicles killed/number of OPFOR vehicles}}{\text{Total BLUFOR vehicles killed/number of BLUFOR vehicles}}$$

Data for over ten thousand MILES rounds fired in 58 defensive missions and 42 offensive missions were used to calculate CXR values.

Since the data analysis requires pairing the unit's training mileage with its performance as computed by the CXR, the unit performance data from the NTC had to be reorganized. Although the tank mileage data were collected from each tank

battalion as a single unit at home station, the tank battalion is task organized into two battalion task forces while training at the NTC. Therefore, the criterion performance measures were formed by first calculating the CXR for each of the two battalion task forces at the NTC on each mission. The CXRs for a given task force on defense were averaged (for the three to five missions fought), as were the CXRs for the sister task force; and the two Mean CXRs for defense were then averaged. A Mean CXR was likewise calculated for the offensive missions.

Predictor Variables

Three predictor variables were hypothesized to be important: first, tank mileage; second, the similarity of a unit's home-station training areas to the NTC; and third, personnel stability. It was found that all units created and maintained a high level of fill in preparation for the NTC (mean=86% on a quarterly measure), so that there was no effective variability in personnel stability (s.d.=4%); hence stability was dropped as a possible performance predictor.

Tank mileage. Monthly reports for the mileage of each tank in a unit were available for the six months preceding a unit's training at the NTC (typically, the period of maximum preparation) from the Army Material Command's Materiel Readiness Support Activity data base that had been built to support tank maintenance. Using these data, the mean tank mileage per month per battalion was calculated.

Similarity to NTC. Three individuals who were highly familiar with the NTC and the home-station training areas of the units sent to train at the NTC were independently asked to rate similarity on a five-point rating scale. As preparation for a summary rating of similarity, ten questions were asked about the nature of home-station terrain, its maneuverability, and availability for unit training. The ratings of the three individuals were found to be in complete agreement for the summary rating.

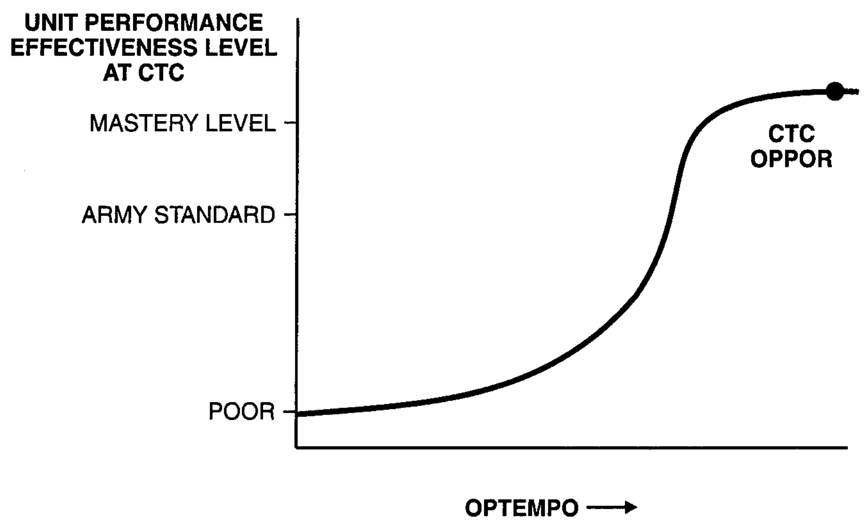
Unit sample. At the point that research was initiated, there were data available from three years of training at the NTC by 16 brigades from five posts. In addition, the NTC OPFOR were treated as a home-station unit for certain analyses; the OPFOR provide data representing an extreme for tank

training mileage, given their intensive year-long schedule of participation at the NTC.

Hypothetical Unit Performance Model

Based on the great body of practical experience and the research literature on the relationship between number of practice trials (see, for example, Bryan and Harter, 1989) or time on task (Carroll, 1963), we may expect a slowly rising performance curve as practice, indexed by tank mileage, begins and increases, then at some point a fairly steep rise, and finally an asymptotic plateauing, as shown in Figure 1, Hypothetical relationship of unit performance to OPTEMPO. Based on the expected curvilinear relationship demonstrated in Figure 1, logarithmic transformations were applied to the tank mileage and CXR values prior to performing linear regression and correlational analyses.

Figure 1. Hypothetical relationship of unit performance to OPTEMPO.

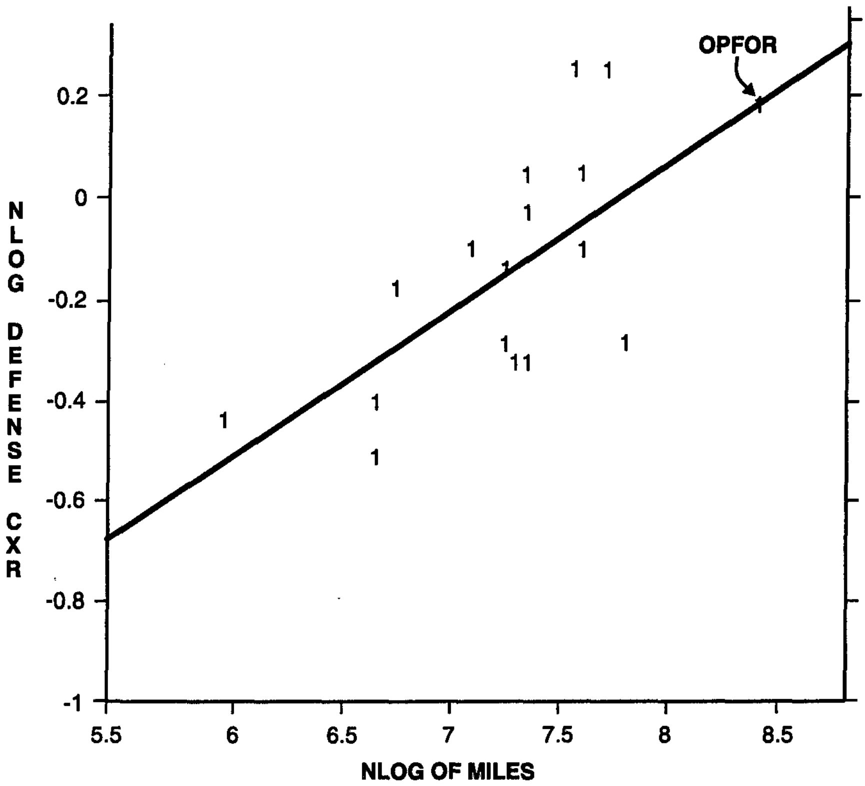


RESULTS

OPTEMPO Correlations

The Pearson product moment correlation between Defensive CXR and tank mileage was .69 with the OPFOR included (N=17, p<.002, see Figure 2, Regression of Log defensive CXR on Log tank mileage); without the OPFOR, the correlation was .64 (N=16, p<.01). There were no significant correlations between the Offensive CXR and tank mileage because of the extreme variability in the BLUFOR performance; that is, sheer amount of BLUFOR training was not predictive of Offensive performance, but the kind of training was, as reported below.

Figure 2. Regression of Log defensive CXR on Log tank mileage.



NTC Terrain Similarity Correlations

Since the distribution of terrain ratings was limited to five scores with OPFOR included and four without, Spearman rank order correlations were calculated. The correlation between CXR and NTC terrain similarity on Offense with OPFOR included was .56 ($N=15$, $p<.05$); without the OPFOR, $r=.51$ ($N=14$, $p<.05$). The correlation on Defense with OPFOR included was .49 ($N=17$, $p<.05$), without the OPFOR, .41 ($N=16$, p.<06).

Multiple Linear Regression Analyses

The two predictors, tank mileage and NTC terrain similarity, were included in a set of stepwise multiple linear regression analyses, with and without the OPFOR, for Defensive and Offensive missions. However, on Defense, only tank mileage was selected at the .05 level of significance. The fact that the two predictors were not able to combine to yield a significantly improved prediction of performance was due to their own correlation, .67 with the OPFOR included ($N=17$, $p<.002$) and .52 without the OPFOR ($N=16$, $p<.05$); this correlation between NTC terrain similarity and training mileage ($r=.52$) implies a tendency for units with greater ranges to take advantage of that opportunity in training.

DISCUSSION

Objectively measured unit performance was found to be positively related to tank training mileage, or Ground OPTEMPO, on defensive missions; on average, as OPTEMPO increases, so does unit performance. Conduct of defensive operations gives an edge to the defender in knowing and organizing the defense to take advantage of terrain held, and that advantage afforded to the BLUFOR tended to neutralize the keen knowledge of terrain possessed by the OPFOR, thus allowing the level of BLUFOR combat proficiency to be revealed.

Although OPTEMPO was not correlated with Offensive mission performance, the similarity of home-station training areas to the NTC was. The OPFOR's vast experience gives them a great ability to anticipate where and how the BLUFOR will typically attempt to move and attack, and the OPFOR's complete mastery of the NTC terrain often enables them to confuse, slow, and decisively block the BLUFOR. Large-scale combat opera-

tions such as those simulated at the NTC are extremely complicated to conduct; they involve combat support and combat service support operations spread across thousands of meters, as well as the operations of the combat arms units whose performance was directly measured. Results on Offense imply that training for Offense requires the opportunity to practice movement and command, control, and communication in large areas at the battalion task force level, as is possible at some posts but not others. The overall pattern of results for Offensive and Defensive missions demonstrates the benefit for amount of relevant practice, as pronounced by Thorndike's Law of Exercise (Thorndike, 1935).

Another interesting training feature demonstrated by the results may be seen in Figure 2, where the performance variability on Defense associated with low mileage is relatively low, but the variability associated with high mileage is high. It appears that units which have a very limited opportunity to train necessarily perform poorly, whereas only some units with a large opportunity to train reap full benefits. Given the moderate size of the correlation between unit Defensive performance and NTC terrain similarity at home station ($r=.41$, or only about 16% of the performance variance is accounted for by terrain), the differences in unit performance with high OPTEMPO cannot be explained simply by differences in home-station training areas. Considering the unpredictable dynamics and complexity of the modern battlefield, the capability of leaders as trainers is also shown here to be important.

CONCLUSION

Results demonstrate that the methodology devised to meet a requirement for determining if OPTEMPO relates to unit performance capability is both practically feasible and useful. The results reported here have in fact been cited by the Secretary of Defense and used to defend the training budget.

Notes

1. An earlier version of this paper was presented to the Army Science Conference, Durham, N.C., 1990.

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Determinants of Effective Unit Performance at the National Training Center: Project Overview[1]

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In 1987, ARI undertook the *Determinants of Unit Performance at the NTC* project to address research questions whose definitive resolution has been as elusive as they have been essential to the Army's mission. A General Officer Advisory Group chaired by then Brigadier General Lawrence Lehowicz validated the issues that this research program addressed. Broadly stated, the project's objective was to assess how Army units can best be manned, led, and trained to maximize their combat readiness. Within that broad goal, the project sought to shed light on two primary questions that underlie many of the core decisions made daily by Army leaders:

- What level of resourcing is required to train units to perform to Army standards?
- How can unit training and training management be improved to maximize combat readiness?

These issues are not new, nor specific to the Army's present circumstances. They are instead questions that have always confronted military leaders. Based on historical analysis and military experience, general answers can be readily supplied. More resources are of course better than less; and battle focused training at home stations should result in more effective combat performance. However, in an era of changing missions and constrained resources, answers that do not account for the competing factors and resource tradeoffs inherent to the current unit environment provide little direct guidance for preparing long-range and mid-term plans, or day-to-day decisions. That guidance must come from analyses of current data and information that jointly consider the wide range of factors that influence unit operations and combat effectiveness.

Data collected on unit performance at the National Training Center (NTC) established the means by which the Determinants project was able to overcome the major obstacle to systematic research on these questions—rigorous and credible measures of unit combat performance to serve as objective criteria for the "determinants" predictor variables. Since the conditions of combat prohibit fine-grained data collection and the requirements of research are not usually supportive of combat realism, research to link unit garrison operations to combat performance was not feasible prior to the availability of NTC performance data. The high degree of realism possible at the NTC and the quality of the data collected there on unit combat operations enabled the Determinants project to examine, as never before possible, how unit tactical performance is related to an extensive range of unit conditions and operations. By comparing unit NTC performance to measures taken on units in the period before their NTC rotation, the Determinants project was able to identify what personnel and training factors distinguished high performing units from others.

The next sections of this overview present the overall design of the project, including the types of data collected and the numbers of units and personnel involved. The discussion of findings that follows the overview of data collection examines each of the issues presented earlier. The discussion of training management is focused on the application of the doctrinal training management cycle of FM 25-100, Training the Force, and on the application of the doctrinal Principles of Training found in the same publication. This summary ends with conclusions and recommendations.

PROJECT DESIGN

Table 1 summarizes the phases and methods of data collection applied to each unit rotation through the NTC. Information was gathered on each rotating battalion for approximately ten months, starting six months before the rotation and ending three months after the rotation.

Baseline data collection was conducted at home station approximately six months prior to the NTC rotation. Data collected included

- **Interviews** conducted with the brigade commander and the battalion commanders associated with the rotation and with members of the brigade and battalion staffs as well as with both the brigade and battalion command sergeants major. Company commanders and first sergeants were also interviewed at this time.
- **Group Interviews** to gather the perspectives of unit personnel and leaders. Separate interview sessions were held with platoon leaders, platoon sergeants, squad leaders/tank commanders, and junior enlisted personnel.
- **Questionnaires** administered to most personnel in the line companies in each battalion.
- Data extracted from unit and installation **records** regarding unit training plans and personnel.

The areas addressed through each data collection method are indicated in Table 1. The objective of these data collection efforts was to develop a picture of the unit in its "steady state," before it had begun any intensive preparation for its NTC rotation.

Throughout the six-month *Train-up* period between the baseline data collection and the unit's NTC rotation, on-site data collectors gathered routine data from unit and installation records about each unit's training plans and activities, use of resources, and personnel changes. This information was used to characterize how the units prepared themselves for their NTC exercises.

Shortly before the actual rotation to NTC, a second wave of surveys and interviews, the *Pre-Rotation* data collection, was conducted. In its sampling and data collection procedures, this effort was very similar to the baseline data collection. However, the emphasis of the pre-rotation effort was on what had occurred during the train-up period and what had helped or hurt those efforts.

During the *Rotation* to NTC, special rating forms were completed by the Observers/Controllers (O/Cs) to measure the unit's performance during each exercise. The O/C rating forms that were used obtained unit mission performance data by Battlefield Operating System and battle phase (planning, prepar-

Table 1
Data Collection Topics, by Method and Phase

	DATA COLLECTION PHASE				
MEASURE-MENT METHOD	**Baseline** *(NTC-6 Months)*	**Train-Up** *(Mo 6 - NTC)*	**Pre-Rotation** *(NTC-2 Weeks)*	**NTC Rotation**	**Post-Rotation** *(NTC+3 Months)*
Survey	- Training Practices - Leadership - Cohesion		- Training Practices - Leadership - Cohesion		- Staff Integration at NTC - NTC Performance - Leadership at NTC - Cohesion at NTC
Individual Interview	- Training Manage-ment		- Unit Training Plans & Activities - Aids & Hindrances		- Unit Strengths & Weakness at NTC - Lessons Learned
Group Interview	- Unit Strengths & Weaknesses		- Aids & Obstacles to Training		- Aids & Obstacles to NTC Performance
Records	- Personnel demo-graphics - Training Plans & Activities	- Personnel demo-graphics - Training Plans & Activities - Resource Use			- Personnel Turnover - Training Plans & Activities - Resource Use
O/C Rating				- Unit Performance - Staff Integration	

ing, and executing). Data were also solicited on the degree of staff integration during the exercise, as were any comments the O/Cs might want to add to further explain the nature of the unit's performance.

Because of their high level of experience in evaluating unit NTC performance (O/Cs on the average participate in 30 unit rotations), O/C assessments constitute one of the best sources of information on the performance of the studied units in their force-on-force and live-fire exercises. Rank orderings of brigade performance derived from the O/C ratings were found to be positively correlated with objective measures derived from the NTC Core Instrumentation System (CIS), which relies heavily

on the hits and kills registered by the Multiple Integrated Laser Engagement System (MILES). The brigade that received the highest O/C rating and that which was given the lowest rating had significantly different casualty exchange ratios, with CXR scores of .87 and .52, respectively (Figure 3).

Post-Rotation data collection included surveys and interviews conducted in the month following a brigade's return to its home station. The surveys and interviews conducted in this period were intended to assess the views of unit leaders and members on their NTC performance and to solicit their judgments on what had aided or detracted from their performance. Record data were extracted for three months after the rotation to track what happened to units after their NTC experience.

PROJECT DATA

Complete data were collected from seven brigades from three continental United States (CONUS) home stations. Table 2 shows the composition of the sample by echelon and unit type. All told, about 2,700 soldiers constituted this set of data.

Table 2
Determinants Project Sample, by Echelon and Unit type

Level of Analysis	Armor	Mechanized Infantry
Battalion Task Forces	7	5
Company Teams	34	22
Platoons	99	69

PROJECT FINDINGS

Issue 1: The Relationship Between Resource Use and Unit Performance

One of the most fundamental decisions Army leaders face, particularly in times of tight resource constraints, concerns the allocation of resources for training. Expenditures in other areas can often be linked to a tangible benefit important to unit readiness, such as the relationship of maintenance costs to equipment readiness levels. Such expenditures can therefore

be more directly projected and defended. For training, the outcome of resource investment, the individual and collective capabilities of unit personnel, is less amenable to direct measurement. Its most credible measurement must instead come from external assessments of unit performance. Because of the high degree of training realism and the quantity and quality of performance data available at NTC, the Determinants project provided an excellent opportunity to examine how objective performance measures taken from units training at NTC are related to the amount of resources used by units when training at home stations prior to their rotations.

The measure of unit levels of training activity and resource use employed for this purpose was the number of vehicle miles expended during train-up. These data were taken from records obtained from the Army Oil Analysis Program (OAP) computerized data base. By comparing mileage measures to NTC mission performance, it was possible to objectively estimate the relationship between levels of training activity (operating tempo) and levels of performance capability, as reflected in combat mission training at the NTC.

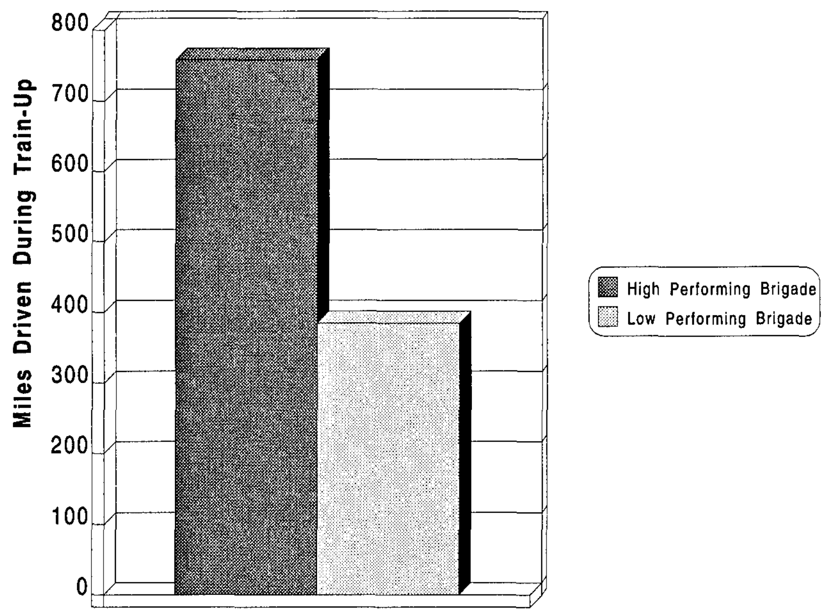
The relationship of resource use to performance was assessed at the brigade level, of which there were seven in the Determinants data set. A data set of this size makes statistical tests of relationships sensitive only to very strong effects. Such strong effects were in fact observed. Statistically significant correlations were found between miles driven in train-up and performance on force-on-force offensive missions ($r = .68$) and on live-fire defensive missions ($r = .80$). These results confirm findings from earlier ARI research (Hiller, McFann, and Lehowicz, 1990) both in their direction and strength.

Looking at the performance of individual brigades, the linkage between resource use in training and combat readiness can be seen in the contrast between the most successful and least successful brigades. As shown in Figure 1, the brigade that was most successful in its force-on-force missions drove its tanks and infantry fighting vehicles almost twice as many miles during train-up as the least successful brigade.

Issue 2: Training and Training Management

The Army's plan for effective unit training is contained in FM 25-100. The overall process for that training is contained

Figure 1. Miles driven during train-up by most and least successful brigades.



within the training management cycle, in which units first determine their training requirements by comparing their current capability to the mission requirements described in their Mission Essential Task Lists (METL). On the basis of that assessment, training plans are to be developed and executed and the effectiveness of the training is to be evaluated to guide the development of further training plans.

The optimal delivery of unit training is further described within FM 25-100 in accordance with principles of training, of which five were examined in detail in this project:

- Train in a combined arms and services team
- Train as you will fight
- Use performance-oriented training
- Train to sustain proficiency
- Train to maintain.

Findings from the Determinants project indicated that units that more fully implemented the procedures stated in FM 25-100 performed better at NTC. Drawing on the extensive data collected through the surveys and interviews of unit per-

sonnel and the record data on unit training plans and activities, each rotation was scored on the degree to which they trained in accordance with the training management cycle and the principles of training. As shown in Figure 2, units that more fully implemented the training management cycle had higher performance in their force-on-force missions. Similarly, a fuller application of the doctrinal principles of training was associated with better performance at NTC (see Figure 3).

Figure 2. Relationship of units' NTC performance to the quality of implementing the training management cycle.

	ROTATION						
TMC Phase	D	A	J	C	E	G	I
METL Development	◕	◕	◕	●	◕	●	◕
Planning	○	○	◕	◕	●	◕	●
Execution	○	●	●	◕	◕	◕	●
Evaluation	◕	●	○	◕	◕	◕	◕
FOF Successes	5	3	2	2	1	1	0
Casualty Exchange Ratio	0.87						0.52

○ High Application ◕ Moderate Application ● Low Application

The Determinants project produced a number of specific findings about the ways in which the more successful units were able to deal with the challenges all units faced in managing and executing their training. These are described below according to the principle of training or phase of the training management cycle to which each is related.

Implementation of the Training Management Cycle

METL development. Overall, the project results showed that METLs are not typically developed in accordance with FM 25-100 and only infrequently identify Mission Training

Figure 3. Relationship of units' NTC performance to unit adherence to principles of training.

	ROTATION						
	D	A	J	C	E	G	I
Train as a Combined Arms & Services Team	○	○	◑	◑	●	◑	●
Train As You Fight	○	◑	○	◑	◑	●	●
Use Performance-Oriented Training	◑	○	○	◑	●	◑	◑
Train To Sustain Proficiency	○	○	◑	◑	●	●	●
Train To Maintain	○	●	◑	●	◑	●	◑
# FOF Successes	5	3	2	2	1	1	0
Casualty Exchange Ratio	0.87						0.52

○ High Application ◑ Moderate Application ● Low Application

Plan (MTP) tasks. Analysis of the METLs that were developed by the studied units revealed that in addition to some MTP tasks, METLs were likely to list only missions and Battlefield Operating Systems. The latter two types of METL entries are problematic in that they do not allow the use of Army Training and Evaluation Outlines (T&EOs) to guide training assessment. Further, they do not support the development of a training focus, the lack of which can lead the unit to trying to accomplish too many objectives, and objectives that are not integrated into a coherent training program. For example, the company-level Army Training and Evaluation Plans (ARTEPs) held during the train-up of the least successful brigade focused on missions rather than specific tasks. It covered three missions (encompassing a total of 47 tasks) in the course of the four-day exercise. In contrast, the corresponding ARTEP held by the most successful brigade concentrated on only 12 tasks (drawn from four missions) over 11 days.

Training assessment. At the beginning of the data collection on each unit six months before its rotation, none of the units had a basis for assessing how well it could operate as a

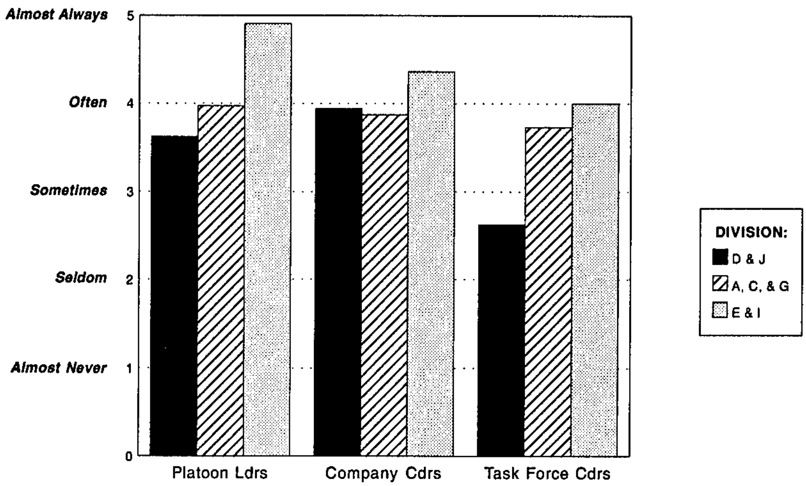
task force in the type of cross-attached configuration to be used at NTC (or anywhere else). None had been to the field recently as a brigade or task force, and turnover had greatly changed their composition, so that the most recent assessment information data were of little direct relevance. Instead, the units established their training status and plans for their train-up on the basis of lower echelon training evaluations.

During their train-ups, the units differed considerably in how much they capitalized on assessments to remedy identified performance problems, and this difference was related to their subsequent NTC performance. The most successful brigade allowed a full month between its company and task force ARTEPs to allow for correction of identified lower echelon deficiencies before training at the task force level. In contrast to this, the lowest performing brigade moved directly from a company ARTEP to a task force ARTEP. The survey data collected from the brigades showed that the different emphasis on addressing observed deficiencies extended throughout the training within the brigades. In responding to a survey item asking how often their units were given a chance to correct weaknesses noticed during training, the platoon leaders in the most successful brigade reported a higher frequency than those from the lowest performing brigade. Units should progress on a training program plan based on achievement of Army training standards and **not** a schedule or clock.

Planning. Training plans are based on the METL developed by the unit and the training needs assessment it conducted. For example, because units often included missions and BOS in their METLs, the training plans often had a mission-level, rather than a task-level, focus. This led to an uneven emphasis across tasks in which the number of times a task is repeated in training is not tied to the repetitions needed to bring task performance to standard and to sustain it at that level.

The implementation of unit training plans was often hampered by the imposition of late or last-minute taskings. Units from the installations sending higher performing task forces reported that such distracters to training occurred much less frequently than the rate reported in the division sending the lowest performing task forces (Figure 4).

Figure 4. Installation differences in the frequency that last-minute taskings interfered with training.



	Platoon Ldrs	Company Cdrs	Task Force Cdrs
Overall Mean	3.90	3.98	3.44
Within Division S.D.	1.70	1.29	0.59
N	137	49	25

Training execution. Much of the project's research that examined the execution of unit training centered on how that execution incorporated FM 25-100's Principles of Training. The specific findings in this area are discussed below in the section concerning those principles. As will be seen in these findings, there are several characteristics of unit training execution that distinguished units that were successful at NTC. The most successful units did not stand out from the others in any one area but in the fact that, across the board, their training was more in keeping with the Principles of Training. This suggests that there is no one thing that a unit can do that will by itself guarantee the effectiveness of its training. Instead, a disciplined application of the principles is necessary to ensure the successful preparation of the unit for combat.

Evaluation. Because units do not typically define their METL in terms of MTP tasks and as a consequence cannot apply T&EOs to assessing their mission readiness, wide differences were found in the evaluation standards used from division to division and over time. This not only hampers the

systematic application of the training management cycle, but also is an obstacle to the establishment and use of "training gates" to determine whether units have mastered basic tasks before moving to the next, more complex, training objective.

Application of the Principles of Training

As was shown in Figure 3, the brigades that displayed the highest proficiency at NTC were those whose training was more completely in accordance with FM 25-100's Principles of Training. The data collected in the Determinants project allowed an analysis of training related to five of the principles described in FM 25-100. The findings pertaining to these principles are described in the following sections.

Train as you will fight. By training in the full configurations that they would use in combat, (i.e., "train as you will fight"), units are able to establish and train on the command and control procedures that will be essential to combat success. At least two sets of results from the Determinants project highlight the importance of reinforcing units' command and control capabilities through training.

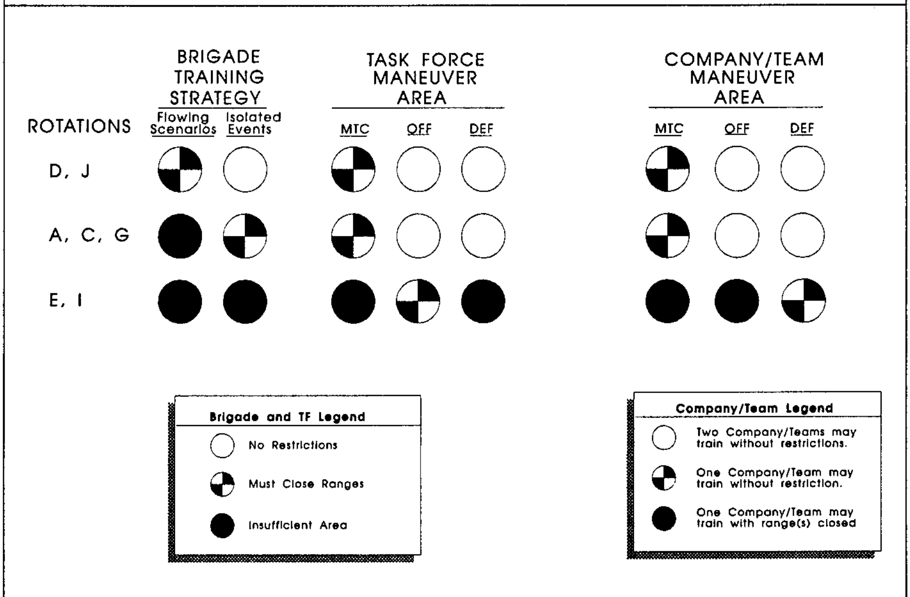
First, the project results showed that units that were successful at NTC tended to cross-attach more completely and earlier in their train-ups. The highest performing brigade, for example, cross-attached companies and platoons from the two battalions rotating to NTC four months before its rotation. This cross-attachment included garrison as well as field activities and extended to moving vehicle and platoon equipment to the appropriate motor pools. The brigade showing the poorest NTC performance, on the other hand, cross-attached companies only three months prior to their rotation. One of its task forces did not cross-attach platoons to form combined arm teams until immediately before its rotation to the NTC. The level of its cross-attachment was also much less complete than that seen in more successful brigades.

A second line of analysis revealed the importance of training for battle staff integration to tactical performance. Ratings of staff integration (such as effective sharing of information during mission performance) were strongly correlated to O/C ratings of NTC mission success. Establishing and training with a Standing Operating Procedure (SOP) appear to underlie the quality of battle staff integration, as seen in successful task

forces. The ratings of battalion staff members of the degree to which they had trained with an established SOP were highly correlated with O/C ratings of mission success (r=.71).

Training realism. FM 25-100 stresses the importance of training realism to the devělopment of unit combat capability. The Determinants research shows that units do not always have the capability to attain a high level of realism due to terrain limitations at their home stations. The severity of these restrictions is inversely related to successful NTC performance. Figure 5 displays the level of terrain restrictions found at each of the three studied installations with respect to the requirements of different types of training. As indicated, the installation sending Rotations E and I, among the lowest performing rotations, had terrain restrictions that severely constrained the type of training that could be performed. On the other hand, the installation sending Rotations D and J, among the highest performing rotations, had training areas and ranges that were far more supportive of realistic training in doctrinal formations.

Figure 5. Installation training area and range restrictions for studied rotations.

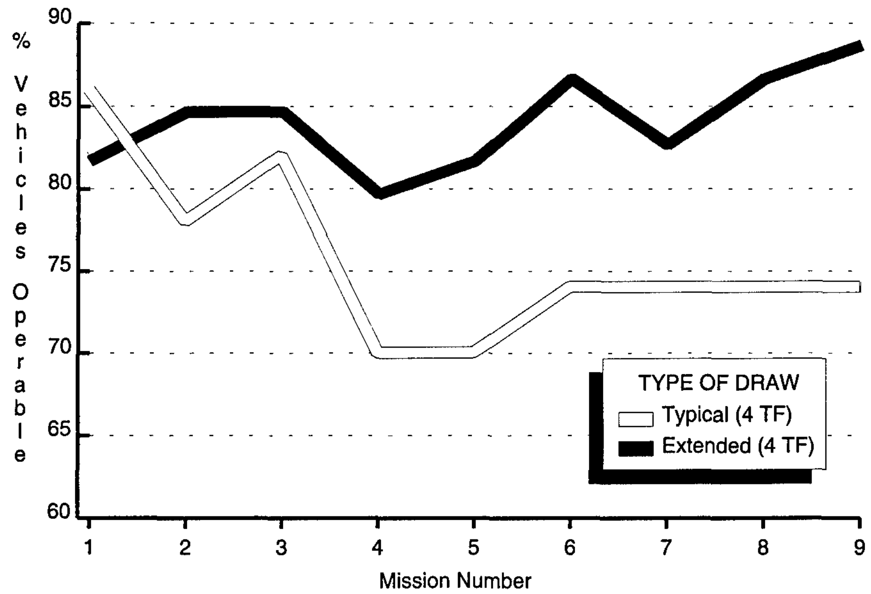


Use training devices/simulators. The Determinants project results highlighted the potential value of one such simulator—the M1 Unit Conduct of Fire Trainer (UCOFT)—though the results suggest that *how* the UCOFT is used is as important as *how much* it is employed in training. Analyses that compared UCOFT scores attained at home station to gunnery scores at NTC showed that these measures were related, but not in a straightforward way. Specifically, the results suggest that training at lower reticle aim levels (firing on a stationary target from a stationary vehicle) benefits defensive gunnery, and the value of that training continues at higher reticle aim levels (moving targets and vehicle). On the other hand, UCOFT scores at lower reticle aim levels are negatively related to NTC offensive gunnery, suggesting that intensive training at that level may actually hurt NTC performance in those tasks. At higher reticle aim levels, that relationship reverses, suggesting that offensive gunnery is aided by UCOFT training at those levels. Taken together, these results indicate the importance of providing UCOFT training across the range of reticle aim levels, a practice that is hampered by the need to requalify crews at lower reticle aims whenever there is turnover in a tank commander (TC)/gunner pair.

Train to maintain. The importance of home-station maintenance training can be seen in the performance of two brigades examined in the Determinants project. In their preparation for their rotations, and in the rotations themselves, the brigades treated equipment draw in the NTC "dust bowl" as a key task. Extended equipment draw procedures were established and implemented at NTC that resulted in higher operational readiness rates for their vehicles, particularly in the later missions in their rotations (Figure 6). By the last mission, the brigades using the extended draw procedures had nearly 14% more operational vehicles than units using regular procedures. All four of the task forces in the two rotations were successful, compared to only two of the other ten task forces.

Train to sustain proficiency. Once individuals and units have attained appropriate degrees of proficiency, they must be provided with opportunities to practice skills and tasks to sustain that level of performance, avoiding steep hills and valleys. The most striking results concern the one brigade that had two rotations during the course of the project. In Rotation A, this brigade performed successfully on three of its force-on-force

Figure 6. Operational readiness rates for rotations using extended and regular equipment draw procedures.



missions. In Rotation G, it performed successfully on only one. Home-station preparation for Rotation G was hampered by a severe shortage of training resources. Comparing the vehicle mileage for the two rotations revealed that the brigade drove 40% more miles on their M1s in preparation for Rotation A than they did in preparation for Rotation G. For M2s the preparation for Rotation A recorded 200% more miles than did preparation for Rotation G.

CONCLUSIONS

The intensive analysis of the units studied in the Determinants project has yielded a wide range of findings on the challenges units face in establishing and maintaining their combat readiness and the strengths they bring to those challenges. Most of the areas explored in the research point rather definitively to ways in which units can best prepare themselves for their wartime missions. Some of the key recommendations that can be made for optimal home-station training include

- Emphasize combined arms tasks in classroom and field training.
- Ensure that a battle task focus is established in unit training plans, particularly by basing unit METL on explicitly identified MTP tasks.
- Ensure that training schedules and the pace of training consider skill decay and sustainment.
- Ensure that training emphasizes the integration of the battle staff and the use of a battle staff SOP.
- Ensure that garrison management problems do not interfere with the availability of training time and resources (such as MILES).
- Establish standards of skill attainment for all tasks.
- Emphasize that equipment draw is an essential part of the realism of the training experience.

Overall, the Determinants project findings have served to empirically validate the training principles published in FM 25-100, Training the Force.

Notes

1. A paper by Holz and McFann which summarized the findings from the Determinants research program appeared in the May 1993 issue of *Military Review.*

Application of FM 25-100 Training Management Cycle in Armor and Mechanized Infantry Units

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This paper presents the findings from the *Determinants of Effective Unit Performance* research in terms of the training management cycle as described in the Army Field Manual FM 25-100, Training the Force. The examination of training management is founded on quantified data to permit precise comparisons across units, particularly with regard to units achieving differing levels of performance at the NTC. However, because of the high level of complexity and changes that characterize a unit's training environment, the interpretation of analytic results and the description of the units' training practices rely heavily on the words of the unit members and leaders who provided much of the data.

The paper begins with an outline of the elements of the training management cycle. Then, each phase of the cycle is addressed separately. The discussion of each phase begins with an introduction summarizing the guidance in FM 25-100 and, where relevant, the findings from the previous phases that may influence performance in the phase under discussion. The discussion is organized around findings related to each phase. The paper concludes with a table that shows graphically how well each unit that conducted training at the NTC implemented the training management cycle.

Data and Methods

The data presented in this paper are derived from two primary sources: interviews conducted with senior leaders (brigade and battalion commanders and S3s) and surveys conducted with personnel before and after their rotation to NTC. The interviews conducted prior to NTC asked the senior

leaders to identify the most successful and least successful elements of their training program. After NTC they were asked to state what they had been able to do best and what they had not done so successfully, and relate that to the training program they had implemented. In their responses to these questions they revealed many things about the management of training.

The surveys asked specific questions related to training management: the availability of resources, the management of time, and the effects of particular distracters.

The primary sources were supplemented with data obtained from group interviews in which each individual could name strengths and weakness of the training program and then all group members independently rated their agreement with each suggestion. Information from training schedules and other documentary sources was also used to complete the picture about the implementation of the training management cycle.

The Training Management Cycle

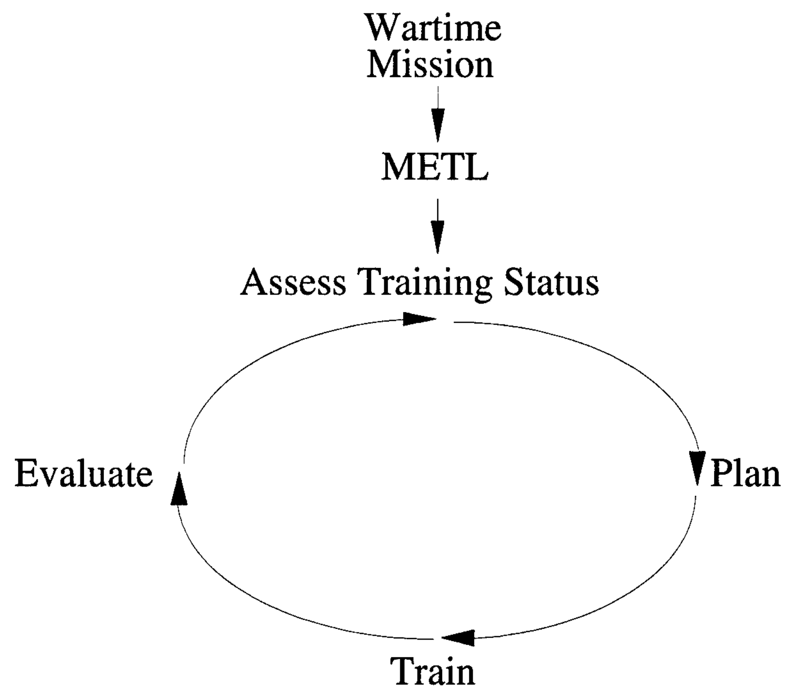
FM 25-100 describes a continuous training management cycle that begins with identification and assessment of needs, proceeds through planning and execution phases, and feeds evaluation data back into the assessment at the beginning of the next cycle. Figure 1 shows the phases of the cycle arranged to show that the process is continuous. The following sections present findings concerning Development of the Mission Essential Task List and Battle Focus; Initial Assessment of Proficiency; Planning of Training; Execution of Training; and Evaluation of Home-Station Training.

METL DEVELOPMENT AND BATTLE FOCUS

The third principle of training[1] in FM 25-100, Use Appropriate Doctrine, indicates that "common procedures and uniform operational methods 'are needed to permit rapid adjustments during battle. In particular,'. . . new soldiers will have little time to learn nonstandard procedures. Therefore, units must train . . . to Army standards contained in mission training plans (MTPs). . . ." (p. 1-4)[2]

The MTPs contain a large number of tasks, and the Army recognizes that it is not realistic to expect units to perform the

Figure 1. FM 25-100 training management cycle.



entire set of tasks to standard. The purpose of "battle focus" is to identify a "reduced number of vital tasks that are essential to mission accomplishment." These become the focus of the training program, and should be trained to Army standards. Battle focus ensures that units train as they will fight. (p. 1-7)

There are two steps to developing an appropriate battle focus. First, the unit (companies are the lowest echelon to apply these rules) derives a Mission Essential Task List. This is a selection of the most critical tasks from all the tasks that are needed to support the unit's wartime mission. Second, the commander at the next echelon above the unit chooses "battle tasks" from the unit's METL. These are the tasks that will be the particular focus of training efforts and evaluations because the senior commander judges that their performance is critical to the performance of an item on *his* METL.

To ensure that training will be aimed at "common procedures and uniform operational methods" and performed to the

Army standard contained in the ARTEP-MTP Training and Evaluation Outlines (T&EOs), the METL for a combat arms unit should consist primarily of tasks drawn from the Army MTPs. The findings in this section are concerned with the degree to which units are able to achieve battle focus through the METL development process. The findings, each of which is discussed below, are that

- METLs are not composed of appropriate MTP tasks.
- Battle tasks are rarely identified.
- Company METLs are not always developed in accord with FM 25-100.
- Concentration on NTC may distort battle focus.
- METL is not the only path to battle focus.

METLs are not composed of appropriate MTP tasks. Unit METLs are composed of missions, operating systems, and tasks, not all of which are from MTPs. Including a mission or operating system in an METL implies that all of the corresponding tasks are critical and does not provide the desired focus. An illustrative METL for a task force in FM 25-101 (p. 2-5) contains seven tasks, of which six (86%) are from ARTEP 71-2-MTP. Table 1 summarizes our findings with respect to the content of the METLs. As will be the case for all tables and figures in this paper, the rotation data are presented in the order of their performance at NTC, starting with Rotation D, the highest performing rotation, to Rotation I, the one with the lowest performance. The results show that generally, only a small percentage of METL tasks appear to be derived from MTPs, even among higher performing units.

Table 1
Percentage of METL Identified as Tasks From ARTEP 71-2-MTP

	Rotation						
Task Force	**D**	**A**	**J**	**C**	**E**	**G**	**I**
Armor	43%	43%	57%	19%	41%	21%	25%
Mech. Inf.	33%	50%	57%	30%	33%*	21%*	53%

* This was also an Armor task force.

Battle tasks are rarely identified. FM 25-100 states that units are to focus their training efforts even further by naming specific battle tasks. "After review and approval of subordinate organizations' METLs, the senior leader selects battle tasks. A battle task is a . . . subordinate organization mission essential task that is so critical that its accomplishment will determine the success of the next higher organization's mission essential task." (p. 2-7) Only one brigade (Rotation E) and one battalion (Rotation C: Mech. Inf.) identified battle tasks. These units did not have especially high proportions of MTP tasks on their METL, so there is no evidence that some units performed the entire sequence of battle focus steps better than others. The items identified as battle tasks were, like the METLs, mixtures of missions, BOS, MTP tasks, and other tasks, indicating that units executing this step did not achieve the degree of focus intended in FM 25-100.

Company METLs are not always developed in accord with FM 25-100. FM 25-100 describes a mentoring process in which the senior leaders work with the junior leaders to develop the junior leaders' METL and identify battle tasks. Some senior commanders dictated the company commander's METL, rather than take the time to coach and explain the senior leader's warfighting philosophy. Reducing the company commander's participation in formulating the METL may result in his being less committed to those tasks. This problem was best exemplified by Rotation I, where one task force S3 said he had written the company METLs. During the follow-up, he said he did not know whether they were still in effect. Checking with the company commanders revealed that one felt he no longer had an METL, another said he had one (that he had derived), but he had not discussed it with anyone at higher echelons, and a third said he did not need an METL because the Quarterly Training Briefing had been canceled. (The fourth commander was not available.)

Concentration on NTC may distort battle focus. The METL and battle tasks are supposed to be derived from the units' wartime missions; however, preparing to go to NTC sometimes distorted training focus. In Rotation A, the Mech Infantry Commander stated that the Brigade had indicated that there would be no night operations at NTC, so they had not been included in the training. After NTC he reported, "We had a terrible time with (night movement at NTC). . . . We had not trained

for it. . . . We had been told that we would not have any night operations and we got them. So that really was painful."

One task force commander from Rotation E said that his focus was set on Live Fire, not Force-on-Force: "(a General Officer in my chain of command) has already told me I'll be a toad if I don't do well at live fire. How I do at force-on-force is of no interest to him."

In Rotation G, one of the two commanders had not anticipated that there would be a rearward passage of lines operation. In retrospect he said he should have been working hard to persuade everyone that those tasks needed to be practiced more.

In Rotation I, the brigade commander put a lot of emphasis on training personnel in the NTC Rules of Engagement, (even giving a written test). One task force in this rotation prescribed what company commanders called an "NTC METL."

METL is not the only path to battle focus. Rotation D provided an example of focus on specific tasks during the conduct of their company ARTEPs. Table 2 shows the tasks that were the focus of these exercises. This company-level training shows clear evidence of focus on "common procedures and operational methods" as defined in Army doctrine. However, this focus did not flow from having these tasks on the unit METL.

Table 2
Rotation D Company ARTEPs—Task-Focused Training

Company-level tasks to be trained (number of repetitions)	
*1.	Employ indirect fire (3)
*2.	Support by fire (2)
*3.	Defend against air attack (1)
*4.	Assault an enemy position (2)
5.	React to obstacle (1)
6.	Breach force/clears wire path (1)
*7.	Perform recon (3)
*8.	Emplace obstacles (2)
*9.	Prep for chemical attack (2)
*10.	Defend (2)
*11.	Perform tactical movement (1)
*12.	Perform actions on contact (1)

* Task identified in ARTEP 71-1-MTP (83% of tasks listed)

The Armor task force commander from Rotation J reported analyzing the warfighting missions and picking out ". . . the key elements there that we need to train." However, there was no paper documentation that identified those tasks as clearly as the training plan for Rotation D. The company-level METLs for this rotation did have very high proportions of MTP tasks.

Summary of Findings Concerning METL Development and Battle Focus

The METL development process is not applied as described in FM 25-100. METLs include missions or BOS as well as tasks. Having missions and BOS on the METL does not focus training efforts, leaving the unit in the position of trying to train too many tasks. Some of the tasks on the METLs are not drawn from the MTP, so they do not have the benefit of Army T&EOs to guide the training and evaluation. This also contributes to a lack of focus and leads to proliferation of nonstandard procedures. Units do not usually identify battle tasks. Subsequent sections of this chapter show that the general failure to provide battle focus leads to problems with implementing the remaining phases of the Training Management Cycle.

Rotation D was the most successful of those studied, and Rotation J was fairly successful. The focus they applied to their training probably contributed to their success, thus supporting the Army's emphasis on battle focus.

INITIAL ASSESSMENT OF PROFICIENCY

According to FM 25-100, the commander is supposed to compare "the organization's current level of training proficiency with the desired level of warfighting proficiency. This desired level is defined in MTPs and . . . other doctrinal literature" (p. 3-1). ". . . leaders must use all available evaluation data to develop an assessment of the organization's overall capability to accomplish each *mission essential task*" (p. 3-1, emphasis added). This assessment is crucial to determining the training requirement, defined in FM 25-100 as ". . . the training necessary to achieve and sustain desired levels of training proficiency for each *mission essential task*" (p. 3-2, emphasis added) This section focuses on information that leaders can use to assess initial proficiency and information that might be used to

shape their training plans. The findings to be presented and discussed are

- Units had no current basis for initial proficiency assessments of brigades, task forces, or company teams.
- NTC does provide information about weaknesses in training programs.
- Some leaders characterized the NTC evaluations as too "negative."
- Combined Arms Command-Training (CAC-Tng) Center for Army Lessons Learned (CALL) publications are generally well regarded.

Units had no current basis for initial proficiency assessments of brigades, task forces, or company teams. Approximately six months before NTC, none of the units studied had been to the field recently as an entire task force or brigade. While there may have been some company-level training, little of it had been conducted in the field and none of it was conducted in the pattern of cross-attachment to be used at NTC. Turnover had changed the composition of the units since their last large-scale exercises, and intended cross-attachments meant that the units would be training in configurations that had not trained together before with their current personnel. The effects of turnover and the changes in cross-attachments also mean that the prior NTC evaluation of the brigade is not relevant as an assessment of current proficiency.

Leaders used evaluations of lower echelon units to establish their training status and plan subsequent training based on this information. Rotation D best exemplified this practice: The Armor task force commander stated, "I think (platoon ARTEPs were) very critical to determine a baseline of where our platoons were." The Mech Infantry S3 stated, "The platoon ARTEPs . . . allowed us to identify key leadership matchups. . . . They set the battalion commander and command sergeant major up with a good idea of where we were."

NTC does provide information about weaknesses in training programs. If the NTC evaluation cannot realistically be used for proficiency assessment, it can be used to identify areas that were not well trained in past rotations so that improvements to home-station training can be made, overall.

From Rotation D, one S3 commented that in the Take Home Package ". . . you get the absolutely most important lessons learned." ". . . you flip through (the THP and find) something . . . that occurs continually through the rotation, that's valuable. The company commanders all looked at that."

From Rotation E, an S3 said they learned from prior rotations that they needed to work on maintenance of vehicles. Their solution was to take some of their own—believing that the NTC stock did not include enough vehicles in good working order to support the six armor companies that went on this rotation.

Rotation E also learned from prior NTC experience that they needed to emphasize live fire. They developed a modified live-fire battle run that helped them to improve their performance considerably.

Rotation G leaders reported that they emphasized live fire and the use of a synchronization matrix in planning operations because of specific feedback from NTC during Rotation A.

It is not always easy to learn from past rotations. It requires a concerted effort to develop and share relevant information. One unit made an effort to capitalize on the experience of sister brigades returning from a recent NTC rotation—probing their leaders about what to be prepared for—with little success: After NTC the task force commander said that obstacles they had encountered were deeper and more complex than they expected. He thought they were not adequately briefed by task forces returning from previous rotations. He also said he had asked an officer in the other brigade how they did orders in the time allowed at NTC, but "he really couldn't help us there."

The commander of one task force in Rotation E wanted to make a commitment to using the NTC evaluations: "I think we have to take our AARs and our Take Home Package and really sort through it and have a commitment to use that stuff in our training strategy. . . rather than just setting it aside and saying, 'Okay now we have ROTC support and we have duty battalion stuff or annual general inspections (AGIs).'" He planned to conduct briefings for the other brigade and, working with them, ". . . come to grips with some training strategies . . . to lick some of these problems."

Some leaders characterized the NTC evaluations as too "negative." Some leaders said it is hard to separate what should be sustained from what was not attained. The brigade S3 from Rotation C said, "(The O/Cs') verbal AARs are marginally worthwhile to me. . . . the problem that you get when you read the Take Home Package is that you don't know what the brigade or the battalion did well because they never put anything in there that they did well."

The commander of the second armor task force from Rotation E was more emphatic about the negative aspects of NTC evaluation: He disparaged the AAR process as one of deliberate denigration of the officers, and cited examples of battles his units "won" where the O/Cs stated, "Well, nothing to learn from this." He went on to say, "So you don't know what you want to sustain, because all you ever hear is bad."

The S3 from the Mech Infantry task force of Rotation I described his home-station AARs as being modeled after the NTC: "They were supposed to kind of grind your ass in the AAR just like they would . . . out in an AAR van in the middle of the desert." He went on to say that this was very different from a true ARTEP process where one would learn that specific tasks were performed to standard or not.

CAC-Tng/CALL Lessons Learned publications are generally well regarded. The Lessons Learned publications highlight performance deficiencies that are judged to be widespread based on the observations of Subject Matter Experts (the O/Cs) at the CTCs. Most leaders indicated that they read the Lessons Learned; one brigade S3 called them "golden material." In practice, units check their training programs to be sure that they have included training in the areas identified in the Lessons Learned as persistent weaknesses.

The Lessons Learned serve primarily to reemphasize doctrine. They emphasize *what* to train rather than *how* to train. None of the leaders we interviewed described any major or systematic changes in training that they could attribute to the Lessons Learned.

The G3 for Rotation J described a systematic plan for using both the Lessons Learned and the THPs in Officer Professional Development (OPD) sessions: "What I did (as an S3) when I went to my rotation is about six months out we started with OPDs where we would review the battles that we had be-

fore and talk about them and what we could have done different." "The battalions use Lessons Learned extensively, again as a resource document for OPDs. . . ."

Summary of Findings Concerning Initial Assessment of Proficiency

Given that a different pair of battalions is drawn from the brigade for each rotation, and given the long time between rotations (relative to the rate of personnel turnover), leaders and units cannot use previous NTC evaluations as input to the initial proficiency assessment of their unit. However, NTC evaluations of prior NTC rotations do contain information about the effects of the training program that the prior units underwent. NTC evaluations are used successfully in this way now, at a "macro" level of performance (e.g., live fire needs work; or one or another BOS needs attention), or at a "micro" level (e.g., use a synchronization matrix). However, some commanders reported that the NTC evaluations are too "negative," making it hard to determine what training was effective and what was not.

The NTC evaluations are not specifically task oriented, so they cannot support the level of detail called for in FM 25-100. If they were, and if battalions (or brigades or divisions) maintained a "corporate history" of their training programs (i.e., how many times each mission essential task was repeated), it would be possible to revise that training program to reflect the strengths and weaknesses revealed in the NTC evaluation. This would more closely approximate the guidance of FM 25-100.

PLANNING OF TRAINING

The purpose of planning is to ". . . (determine) the minimum frequency each *mission essential task* will be performed during the upcoming planning period" (FM 25-100, p. 3-2 (emphasis added)). Table 3 reproduces Figure 3 from FM 25-100, which describes the content of three types of training plans.

Long-range plans set the stage by identifying METL and battle tasks and establishing training objectives for each mission essential task. They establish schedules for facilities and long-lead-time resources to ensure that appropriate opportunities to train will be provided. They also facilitate coordination

Table 3
Content of Three Types of Training Plans

Long-Range Training Plans	Short-Range Training Plans	Near-Term Training Plans
* Disseminate METL and battle tasks * Establish training objective for each mission essential task * Schedule projected major training events * Identify long lead time resources and allocate major resources such as major training area rotations * Coordinate long-range calendars with all supporting agencies to eliminate training detractors * Publish long-range guidance and planning calendar * Provide basis for command operating budget input * Provide long-range training input to higher headquarters	* Refine and expand upon appropriate portions of long-range plan * Cross-reference each training event with specific training objectives * Identify and allocate short lead time resources such as local training facilities * Coordinate short-range calendar with all support agencies * Publish short-range guidance and planning calendar * Provide input to unit training meetings	* Refine and expand upon short-range plan through conduct of training meetings * Determine best sequence for training * Provide specific guidance for trainers * Allocate training devices, simulators, simulations, and similar resources to specific trainers * Publish detailed training schedules * Provide basis for executing and evaluating training

with other agencies to eliminate major distracters. Short-range and near-term plans are supposed to ensure that units are free of distracters and properly resourced to conduct the events previously scheduled through the long-range plans.

In addition to findings concerning long-range planning, time management, and distracters (discussed later in this section), this project revealed one general finding related to the overall process by which units develop their training plans, namely, that unit training plans are not based on how often tasks must be repeated.

Training plans are not based on how often tasks must be repeated. Having found that the units studied did not focus on tasks and did not have assessments of task performance at all echelons to use as the basis for planning, we turn now to the issue of overall planning of training. The units we studied developed long-range plans by laying out training events starting with lower echelons and working up to higher echelons. These plans were timed to have externally evaluated task force training exercises conducted shortly before the rotation to NTC. The mission-level focus of their METLs led to the training events being planned around specific missions. This type of planning, however, did not facilitate monitoring how frequently tasks were repeated. Units planned for repetitions of certain missions, but many tasks appeared in more than one mission, resulting in unven task repetition. The extract from the company-team training plans for Rotation D, in Table 2, shows that when tasks are the focus of the training and assessment, units can plan the frequency of task repetitions.

Army guidance for planning training at the company-team level (ARTEP 71-1-MTP) illustrates some of the problems with a mission-oriented approach to training. This document suggests a total of 7 field training exercises (FTXs) (one for each mission) and 19 supporting situational training exercises (STXs). It is unlikely that a company would be able to devote the time required to performing all of those exercises during the course of a six-month training period. Even if this were possible, there would be a wide variation in the frequency of training opportunities across tasks: Ten tasks (including Perform Guard Operations, Delay, and Prepare for Chemical Attack) would never be trained, while five tasks would be trained seven or more times, including Perform Tactical Movement and Maintain Operation Security, which would each be trained eleven times.

Additional findings about the planning process are presented in three segments: findings regarding long-range plans, findings about time management and distracters, and findings about resource management.

Findings About Long-Range Planning and Time Management

The orderly development and execution of any long-range plan requires a stable (or at least predictable) environment op-

erating on a consistent and relatively stable set of priorities. However, the Army unit environment cannot be characterized by these factors. The findings of the present project make clear that the challenge of planning systematic training in the turbulent environment of the Army unit remains endemic, specifically

- Long-range planning is not sufficiently comprehensive.
- Unforeseen contingencies disrupt long-range plans.
- Even if foreseen, some necessary activities may have a negative effect on training.
- Long-range plans do not include opportunities for sustainment training after NTC.
- Time management is a problem.
- Higher commands are sometimes the source of serious distracters.

Long-range planning is not sufficiently comprehensive. Following Rotation A, the brigade commander indicated that the long-term plan for his unit's next rotation (called Rotation G in this paper) would be severely constrained by lack of funds because the division was going to send its other brigade to NTC later in the same fiscal year (called Rotation C in this report.). Either the long-range planning process did not reveal that the schedule of rotations to NTC would deplete the division's training dollars to the point that this brigade would essentially be unable to train until the new fiscal year provided more dollars (about three months prior to Rotation G), or the long-range planning process was unable to resolve the dilemma by reallocating resources.

The brigade S3 for Rotation E indicated that they had to modify their training plans because the long-range plan had their peak training time coincide with the time Reserve Officers Training Corps (ROTC) units would be using all the ranges and training areas.

Unforeseen contingencies disrupt long-range plans. In each of Rotations I and J one battalion had to spend about one month supporting disaster relief efforts. This meant that their training schedules either had to be compressed to fit more training into a shorter time, or the nature of their training had to be altered. The brigade commander for Rotation I stated that

he lost a "critical month of platoon training (for Armor)." He describes how he changed the initial brigade's training plan: "The first thing we did was [to] put a lot more . . . emphasis at the platoon level." Because of the lack of maneuver time, he ". . . designed a series of vignettes that are designed to test and train on the basic skills that I think a platoon needs to have."

Requirements to test and field new equipment are not always easy to incorporate into long-range plans. The reason Rotation E sent two armor battalions was that the schedule for new equipment training on the Bradley Fighting Vehicle for the infantry battalion was changed abruptly.

The brigade S3 for Rotation G said that because of a new equipment test requirement, the plans he had made for using simulations to sustain the brigade staff level of training after the rotation were "out the window."

Even if foreseen, some necessary activities may have a negative effect on training. In Rotation I, while the armor battalion went on disaster relief, the Mech Infantry Battalion had new equipment training on the Bradley Fighting Vehicle. The brigade commander commented (prior to NTC) that this left too little training time: ". . . we had about . . . two and a half months to teach the infantry to think at 35 miles an hour rather than 12. I don't know that I am there yet."

Long-range plans do not include plans for sustainment training after NTC. The brigades examined have three active battalions. This means that one of the battalions in each NTC rotation will 'sit out' the next rotation from that brigade.[3] Sustaining that battalion over that span of time is difficult. Divisions tend to place the nonrotating battalion at the top of the list to draw details. One task force commander placed in this position reported that after NTC, requirements on him to support training at places off-post tripled compared to the plans he had seen prior to NTC: "I said (to the brigade commander), 'Sir, do you realize that I'm going to be gone for nearly six weeks out of about a ten-week period. . . physically away from the state?'"

Another task force commander stated that he would focus post-NTC efforts on individual, crew, and platoon training, supplemented with Officer and Noncommissioned Officer Professional Development in part because that is where he felt effort was needed, but also because, "I don't have the resources to do anything else but that."

The S3 of one task force in Rotation G summarized the problem: ". . . when you come back, you have your After Action Reports, what you supposedly did wrong, what you need to correct. Yet you can't concentrate on it. You immediately go off into doing other things to support the other brigade."

Time management is a problem. FM 25-100 says that divisions should adopt a green-amber-red time management system (see Table 4), where green time is allocated to collective tasks; amber time is allocated to small unit, crew, and individual tasks; and red time is primarily devoted to administrative

Table 4
Green-Amber-Red Time Management System
(FM 24-100, Figure 3-7).

Green Period	Amber Period	Red Period
Training focus primarily on collective tasks with individual and leader tasks integrated during multi-echelon unit training.	Small unit, crew, and individual training emphasized.	Diverts the minimum essential number of personnel to perform administrative and support requirements.
Maximum soldier attendance at prime time, mission essential training.	Provides time for soldier attendance at education and training courses.	Suborganizations take advantage of all training opportunities to conduct individual, leader, and crew training.
Coincides with availability of major resources, such as major training areas (MTAs), local training areas (LTAs), and key training facilities or devices.	Some suborganizations may be able to schedule collective training.	Support missions/details accomplished with unit integrity to exercise the chain of command and provide individual training opportunities for first line supervisors as time permits. Unit tasking can be used to reduce the number of permanent special duty personnel within installations and communities.
Administrative and support requirements that keep personnel from participating in training eliminated to the maximum extent possible.	Scheduling of periodic maintenance services.	Leaves and passes maximized. When appropriate, block leave may be scheduled.
Leaves and passes limited to the minimum essential.	Selected personnel diverted to support requirements when all available personnel in organizations in the red period are completely committed to support requirements.	Routine medical, dental and administrative appointments coordinated and scheduled with installation support facilities.

and support requirements. All divisions reported difficulties in implementing and managing this system.

The surveys conducted prior to NTC contained three questions particularly directed to the management of time. Two of the questions concerned the amount of training time spent actually training and the percentage of duty time applied to mission essential training:

- When your (unit) goes to the field for tactical training, how much of the total time available is spent actually training at the training site (i.e., instead of drawing equipment, traveling to the site, or waiting to train)?
- During the past three months, what percent of your *normal duty time* was spent on *mission essential* training activities?

For each item, respondents checked one of five responses, and project personnel entered a corresponding numerical code into the data base for analysis. The coding scheme was as follows:

Code	**Response**
5	90% to 100%
4	75% to 89%
3	50% to 74%
2	25% to 49%
1	Less than 25% of the time

The third question was about the accuracy of the training schedule:

- During the last three months, what percent of scheduled training took place as planned on the training schedule?

The responses for this item were slightly different to reflect the idea that having less than 40% of the planned training take place as scheduled would indicate a very serious problem:

Code	**Response**
5	90% to 100%
4	75% to 89%
3	60% to 74%
2	40% to 59%
1	Less than 40% of the time

The responses of platoon leaders, company commanders, and battalion commanders and S3s to these questions were examined. Analysis of variance was used to determine if there were significant differences among the rotations. This analytic technique was also used to identify whether the variation was among the three divisions (indicating that there are persistent differences from division to division in managing time) or among rotations within divisions (indicating that time management depended on the particular brigade in control of each rotation).

Responses to the question concerning the amount of time actually spent training revealed statistically significant variations between divisions in the responses of the platoon leaders. Otherwise, there were no statistically significant variations between rotations or divisions. Each echelon of leaders rated the division sending Rotations E and I (two of the three lowest performing rotations) below its overall mean on this item.

Responses of platoon leaders, company commanders, and Task Force commanders to the item concerning the accuracy of the training schedule, while statistically different, did not fall neatly into a pattern of between-division or within-division variation.

The third item, concerning the proportion of duty time spent on mission essential training, resulted in statistically significant differences among rotations for all three groups of respondents. There was little agreement among echelons as to which rotations were high and which were low.

The surveys given to leaders prior to each rotation also contained questions about the impact of various training distracters. These leaders were asked to rate the extent to which each of the following three items related to scheduling and time management detracted from training:

- Post Support and Details (e.g., Guard, Police, ROTC, and Reserves Support)
- Late or "Last-Minute" Taskings
- Schedule Changed by Higher Command(s).

In responding to these items, each leader checked one of the following responses representing how often each distracter impacted effective mission essential training using a scale that

varied from "almost never" (assigned a code of 1) to "almost always" (assigned a code of 5).

The overall means indicate that these distracters occurred more often than "sometimes," ($\bar{x} = 3.3$). Even though the means for Rotations E and I were above the overall mean for each echelon ($\bar{x} = 4.2$), the difference between divisions was not statistically significant. These two brigades were both in "red cycle" during the month just prior to NTC. The ratings for Rotation E are especially low, and may reflect the fact that they were not able to train in the field for a long period between company/team exercises and task force exercises because ROTC units were using the home station's ranges and training areas.

Late or "last-minute" taskings and schedule changes from higher were more troublesome in the division sending Rotations E and I (among the lowest performing rotations) ($\bar{x} = 4.2$) than they were in the division sending Rotations D and J (among the highest performing rotations) ($\bar{x} = 3.5$).

Analysis of the ratings by battalion commanders and S3s indicates that they reported statistically significant differences from division to division on the items dealing with last-minute taskings and changes by higher commands ($p<.03$). Platoon leaders tended to agree with the other echelons in their ranking of the divisions, but division-to-division variations in their ratings were not statistically significant. The variation from rotation to rotation was statistically significant ($p<.02$), with platoon leaders particularly identifying Rotation C as the lowest overall. Rotation C was rated below the overall mean by the other two echelons also (but not by a large enough margin to make rotation-to-rotation variance statistically significant).

The responses for each rotation of battalion commanders and S3s on the items concerning last-minute taskings and changes by higher commands revealed important differences. Battalion commanders and S3s from the division that sent Rotations D and J, the highest performing units, reported less training detraction caused by last-minute taskings and changes in training schedules than their peers at the other divisions. Battalion commanders from the division that sent Rotations E and I, the lowest performing units, reported the greatest amount of distracters.

The following extracts from the interviews exemplify the problems with scheduling and distracters that were reported by the leaders in the various rotations.

The brigade S3 for Rotation D said that when they began to lay out the schedule (about eight months prior to NTC), they decided to change from a "very condensed (30-day) intense period" to spread training out over a longer period (about two and a half months). They were told that the division would ". . . adjust the support cycle to facilitate your being green during these collective training periods." But this verbal commitment was not fulfilled.

Rotations E and I were obliged to be in red cycle just prior to NTC. Rotation E also had to modify training plans because the original plan placed a green cycle during the time ROTC units would be on post, using the ranges and training areas. The modification allowed them full use of the facilities, but created a large gap between their company-level and task-force-level FTXs.

Group interviews with company commanders, first sergeants, platoon leaders, and platoon sergeants in Rotation E all identified support details as a problem during their training cycle. One of the task force commanders from this rotation reported feeling so constrained by lack of time and personnel turnover that he ". . . taught . . . Soviet tactics on the assault. We're not smart enough to do anything else, plus I suspect Soviet tactics work better than some of the things we try to teach ourselves."

One task force commander in Rotation G said that providing support for another brigade (being their O/Cs), while a learning experience, takes ". . . time away from our own soldiers, time away from our own equipment." His S3 also cited support for the other brigade as a distracter. Leaders in Rotation C made it clear how supporting another brigade can interfere with multi-echelon training by taking the senior NCOs and officers to evaluate the other brigade's exercises while the junior NCOs conduct maintenance training. The brigade commander for Rotation C said, "You have to have the more senior guys there so that the junior NCOs get trained before they can be expected to train their crews." One of the task force S3s from that rotation agreed, saying, ". . . when all the leaders were away (evaluating the other brigade), we didn't have the

leadership or expertise back with the soldiers in garrison to do quality individual training."

The division G3 for Rotation J said that NTC is used to prioritize everything: "We start with a blank piece of paper and the NTC rotation goes on it first and all things revolve around that. Who pulls post support and who gets to shoot on ranges . . . is based on who goes to NTC." Despite this orientation around the NTC rotation, the brigade S3 for Rotation J indicated that the "NTC priority window" was "only long enough to start at the Company level, do Company team STXs, do an ARTEP and go." He felt that trying to run platoon-level collective training during the brigade's red cycle was too hard, "and I know that the platoon-level training suffered." He said that the division does nothing to align post support cycles with training and foresaw the same problem with platoon training for the next year.

Higher commands are sometimes the source of serious distracters. In one division a new division commander and assistant division commander (ADC) decided that the long-range plans of the brigade preparing for NTC needed to be modified only a few months ahead of the rotation. The mech infantry commander says that incorporating their many "good ideas" resulted in having to make four or five plans for each major training event. The division commander extended the time in the field after the task force ARTEP. Group interviews at all levels indicated that this time was wasted because there was no plan for organized, resourced training. The Armor S3 said this action ". . . totally destroyed whatever we had left of our long-range plan, and did nothing to prepare us." The mech infantry S3 said that he had to substitute executive officers (XOs) for company commanders in the Army Training Battle Simulation System (ARTBASS) exercise he had planned for this time period. The brigade commander said that it helped build cohesion at the brigade level, but caused a loss of opportunities to walk through NTC battle scenarios on the "planning boards" in garrison.

The brigade commander for Rotation C said, "It's not necessarily nontraining tasks that are taking us away (from the basics we need to be training in). It's too many good ideas, too many training tasks. . . . We've got to pay attention to FM 25-100." One of the S3s in Rotation E also stated that there were

a lot of last-minute "great . . . ideas" from above that caused changes in schedules and disrupted training.

Administrative burdens made it difficult for brigades to participate in training, but some brigades seemed to have solved this problem. The commander of one task force in Rotation E said (prior to NTC) that he was not able to get time to have his staff train with the brigade staff. He thought that if division would pick up certain administrative tasks, "Then the brigade staff can do their battle staff drills, especially interaction with my guys, much better." The division G3 for Rotation J said that the division was specifically directed to take care of certain administrative details, relieving the brigade staff of some of that burden and allowing it to play in a tactical role.

One of the task force S3s for Rotation J summed up the feeling that distracters create in this way: "Although we've been trying to focus on NTC, there are . . . other training requirements, support requirements, mandatory training . . . . It's almost like you've got to really fight to do the thing that you think is most important—and everyone above you says is most important—but somehow it doesn't translate down to being a commitment."

Findings About Resource Management

- Resourcing varied from rotation to rotation.
- Management can create problems even when resources are available.

Resourcing varied from rotation to rotation. The primary demand on resources is to provide realistic training in the field, and some of the effects of varying resources are discussed under the principle of training "Train as You Fight" in the next paper. The variations seemed to be related mainly to whether or not the divisions had resources available during the train-up.

The following extracts from interviews conducted just prior to the NTC illustrate how resource problems influenced training.

Rotation D seems to have been very well resourced. The Infantry task force commander stated, "I have not restricted my guys. . . . We are trying to develop a good Prescribed Load List (PLL) and the proper number of lines and types. Authorized Stockage List (ASL) probably hurts a little more. The division

just does not have the ASLs to support some of what we have and that is a conscious decision because we don't have any way to haul it." One of the task force S3s described the rich environment created for the company-level ARTEPS: "It was a high overhead operation where each company went through a series of lanes and we had OPFOR acting like Soviets out there. We had all the pyrotechnics in the world, and lots of O/Cs out there."

Addressing the question of resources, the brigade commander of Rotation J said, "I will tell you that money was not a constraint. The guidance we received from the division was training full up, and I'll consider it a shortfall for the rest of the year. . . ." The brigade S3 confirmed this: ". . . I feel we've gotten our fair share: we've had money to train, we've had fuel, we've had land. . . ." Many of the group interviews, however, indicated that there was a shortage of blank ammunition, especially Hoffman rounds.

Interviews of leaders in Rotation E describe the preparation period as lacking resources. Again, lack of PLL is cited as responsible for shortages of vehicles during training. One task force commander said, "I was not satisfied . . . with our operational readiness rate. . . . It was just that we didn't have the parts to fix the stuff when it got broken." He had "12 or 13 tanks down at once" when he was on the range or in the field. The other task force commander also cited PLL, but blamed the support personnel, as well: "What I think is totally broken in this brigade is our support battalion." "I got trucks and vehicles that have been down 40 to 50 days because the support battalion breaks them. . . ."

Rotation G was very low on resources. One task force commander said that they were limited to 250 miles per vehicle prior to NTC (the brigade commander reported that they put 500 miles on each tank while at NTC). This mileage restriction was accompanied by a shortage of spare parts. One task force commander said that the lack of M1 service kits ". . . caused us to skip scheduled tank services, so during our train-up we were also conducting M1 tank services." "A company commander would have two platoons out on the field doing platoon training or company training, while one platoon was back in garrison doing a service." The group interviews at all levels revealed an "austere" resource environment with shortages of ammunition,

spare parts, and cannibalization of vehicles. Gunnery training was particularly shorted—Tank Gunnery Table V and VI were not performed. One of the task force commanders stated that this made performing the advanced tables more difficult.

It is not clear whether resources were lacking for Rotation I, or whether the scheduling problems created a situation where the brigade commander decided to use a training strategy that was, coincidentally, lower cost. This strategy focused almost exclusively on platoons: ". . . we did hardly any company training. Battalion level training was only four days. I rolled the dice on the platoons and that's where I put all my emphasis and we hope it pays off."

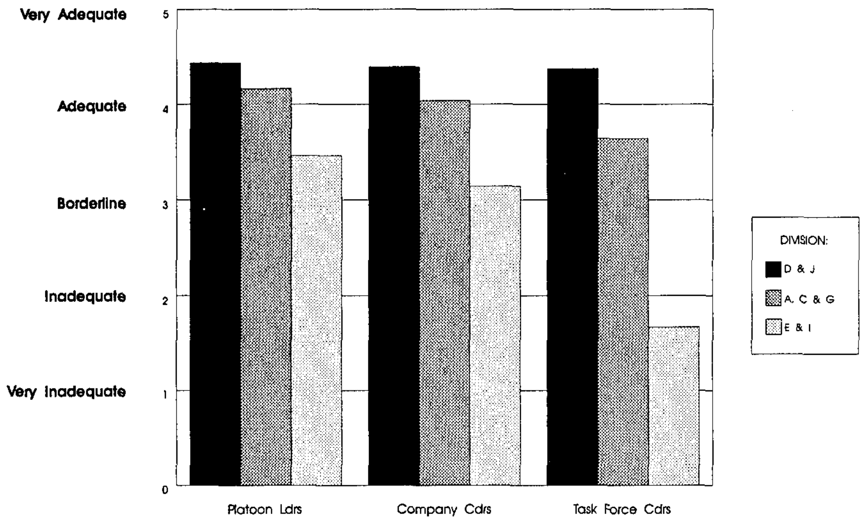
Speaking more broadly, one task force commander said, "I'm going to be in command for two years. . . . During that (time) I will have my task force together as a battalion at the NTC for two weeks, (plus six days at home station), and that's it. Three weeks out of 104 that we can train as a battalion. There's no way we can be prepared to go to war in 15 days . . . on that kind of a schedule."

Management can create problems even when resources are available. Rotations E and I (from the same division) had difficulties managing MILES equipment. Surveys conducted prior to NTC included a question about availability of MILES equipment. Leaders from this division gave ratings that were much lower than those of leaders at other divisions, as shown in Figure 2. The differences among divisions are statistically significant at each echelon ($p<.01$ for platoon leaders and for company commanders; $p<.05$ for battalion commanders and S3s). Most ratings are between a scale value of four (meaning "adequate") and 5 ("very adequate"). The mean rating of the battalion commanders and S3s from the division sending Rotations E and I is between scale values of 1 ("very inadequate") and 2 ("inadequate"). The center of the scale was a value of 3 ("borderline").

The problem with MILES equipment that affected both rotations from this division is described in Vignette 1.

The other division that sent two armor task forces (with fewer armor platoons) did not report problems with MILES. The remaining division indicated that outfitting two task forces (mixed armor and mech infantry) required all of its MILES equipment.

Figure 2. Availability of MILES equipment, by rater position and division.



	Platoon Ldrs	Company Cdrs	Task Force Cdrs
Overall Mean	4.05	3.90	3.40
Within Division S.D.	0.28	0.54	1.38
N	138	51	25

Vignette 1: Problems managing MILES equipment.

Rotation E had two armor TFs with a total of six armor companies. They had more vehicles than they had complete sets of MILES equipment. One of the S3s said that during the TF FTX they had to swap the gear back and forth and lost track of small items, hand receipts, etc. This brigade took about 60 sets of MILES to NTC in the belief that NTC could not support six companies of tanks. The company commander group interviews indicated severe problems with lack of MILES and with being unable to turn it back in (due to the condition of the equipment and loss of hand receipts). Rotation I, which occurred less than four months after Rotation E, was without MILES gear for a substantial part of its train-up. The armor commander of Rotation I stated, ". . . even after they got back, their delinquency in turning the MILES in (kept us without MILES)." Lack of MILES equipment diminished the realism of home-station training exercises for Rotation I.

Summary of Findings About the Planning of Unit Training

In practice, planning of unit training does not serve the functions outlined in FM 25-100. Long-range plans do not have the flexibility to accommodate unforeseen contingencies. Long-range plans do not provide for sustainment training after NTC. Some units had difficulty managing time and avoiding training distracters. Some units had difficulty with providing the resources needed for training even when they were available on the post.

It is difficult to identify systematic deficiencies in the planning process itself. The units appeared to plan and to conduct briefings about their plans as recommended in FM 25-100.[4] The lack of battle focus described earlier seems to result in units conducting a series of events, but failing to capitalize on the opportunities for training those events should provide. The scheduling of the events is not based on the learning curve of the units, but on other factors (when facilities and resources can be made available given other claims and constraints on their use). Data on last-minute taskings and changes to schedules imposed by higher commands indicate that the planning process does not yet achieve the goal of fencing off personnel, resources, and time to allow training to Army standards to occur. To repeat a previous quotation: "It's almost like you've got to really fight to do the thing that you think is most important—and everyone above you says is most important—but somehow it doesn't translate down to being a commitment."

EXECUTION OF TRAINING

The findings about home-station training and NTC performance are presented in the following paper. That paper examines how well units applied the principles of training to their training activities and shows that fidelity to the principles of training is related to effective performance at the NTC. This section of this paper discusses the management of the execution of training at home station and focuses on the extent to which units were able to tailor training to meet the needs of their subordinate echelons.

FM 25-100 describes a cycle of continuous monitoring and improvement: Information about training needs should flow up from the lowest echelons (based upon results of their training

activities), where it will influence training plans at higher echelons. "Near-term planning includes the conduct of training meetings to create a bottom-up flow of information regarding specific training proficiency needs of the small-unit and individual soldier." (p. 3-18) Evaluation results in identification of weaknesses, and time should be provided to retrain. "A major aspect of short-range training event design is the preplanned scheduling of time for additional training prior to the end of the training to ensure that all training tasks are performed to standard." (p. 3-14)

We have already demonstrated that units have difficulty identifying specific tasks as the focus of efforts to develop proficiency. Thus, they have difficulty making task-based proficiency assessments. The next section focuses on evaluation, looking at the standards units use to assess proficiency. The findings in this section concern whether units have time to acquire and integrate information about proficiency, and time to act on it through retraining. There is one finding to be elaborated in this section:

- Units have little opportunity to tailor training to the needs of their subordinate echelons.

Units have little opportunity to tailor training to the needs of their subordinate echelons. Prior to training at the NTC, leaders in each rotation were asked whether their units were given a chance to correct weaknesses noticed during training. They could respond by choosing one of five answers ranging from "almost always" (assigned a code of 5) to "almost never" (assigned a code of 1).

The leaders completing the items were grouped into three echelons: Platoon leaders, company commanders, and battalion commanders and S3s. Findings indicated that there was an overall trend for leaders at higher echelons to report having fewer opportunities to correct weaknesses. The average rating of battalion commanders and S3s was between "seldom" and "sometimes," while the average rating of platoon leaders was between "sometimes" and "often." This progression is reasonable because the lower echelon leaders can use participation in exercises at higher echelon levels to correct weaknesses; leaders at the highest echelon have fewer opportunities to correct weaknesses they perceive in the capabilities of their units.

There were statistically significant differences among rotations as rated by platoon leaders ($p<.03$) and by task force commanders and S3s ($p<.02$). The differences reported by company commanders were not statistically significant. However, they did tend to agree with leaders at the other echelons as to which rotations were above average and which were below average.

The observed rotation differences in the responses to this item parallel (though they do not perfectly replicate) the rotation differences in NTC performance. Rotations I and J were below the overall mean in each echelon, while Rotation D was above the mean.

The following extracts from the interviews illustrate how leaders felt training was influenced by the opportunities (or lack thereof) to correct weaknesses.

The Mech Infantry Commander of Rotation A said, ". . . there's not enough time to assimilate what you've learned and talk about it to fix it before you launch into the next one." His S3 said, ". . . in some cases we never even got the feedback from one event before we started the next." Even the feedback that was given was not task oriented: ". . . there was never really clear communication as to what the problem was, other than 'logistics was screwed up,' or 'maintenance was down to 50% mission capable and obviously you have a problem.'" The armor commander for this rotation said there was no time to train prior to each formal evaluation event and no time or resources to correct mistakes between events. His S3 said, "There was not that period to digest lessons learned, turn around, retrain, reprepare for the next one, and then go out and do it again."

For Rotation C, the division-developed training plan left little leeway for tailoring training to the unit's needs. Group interviews with platoon leaders and sergeants indicated that they felt the needs of the platoons were not considered in planning the training activities. Company commander group interviews tended to confirm this deficiency.

One task force commander from Rotation C described the linkage between having time to train-evaluate-retrain and being able to tailor the training program in this way: " . . . we were . . . never asked, 'What do you need to do in order to prepare for the NTC?' It was dictated to us by people who are not in the battalion. We were sort of labeled like we are a generic

battalion. I think that is probably good for the 80% solution, but if I had my druthers what I would have done is had a training period before we started the formal STX training to identify the problem areas that I needed to concentrate on during the STXs. . . ."

The brigade commander from Rotation C associated the problem with lack of resources: "They . . . didn't have the time nor money to repeat exercises when they found weaknesses." One task force commander reported, ". . . our guys never got to practice . . . . Then when we screwed it up on a situational training exercise (STX), we really don't have the time to go back and do it again." Reflecting on the brigade's train-up after returning from NTC, the brigade commander said, "The tasks that need to be trained need to be coming from the crew and the platoon level sergeants through the company to the battalion instead of coming down from above saying this is what you must go train and do. We've got to do that right."

At the end of Rotation A, it was clear that the division was going to devote its resources to training its other brigade (for Rotation C), and there would be little field training for the Rotation A brigade before their next NTC rotation (Rotation G). The training schedule for Rotation G was very compressed because resources became available only three months prior to the rotation. The brigade S3 describes the training as designed, in part, by input from a general officer high in the chain of command who said to try gunnery and maneuver training simultaneously. "So we did that. We were doing (Tank Gunnery) Table VII, Table VIII, we moved into Platoon STXs, went back to Table XI, Table XII, moved into company STXs. Lost our task force STX due to some quirks in the schedule, . . . (so we) combined company and task force STXs." Even with this compressed schedule there was apparently time for retraining, based on the data in Figure 14. However, the group interviews with platoon leaders and platoon sergeants indicated that there was a lot of wasted field time, so there might have been some opportunities that were not used fully. The platoon leaders from Rotation G gave the lowest average rating (3.57) of any echelon or rotation to the survey item on actual training time compared to total field time (reported in Figure 2). This division had the brigades spend long times in the field at the end of the preparation period. All of this time was not put to productive use. Some groups interviewed after NTC did feel that it pre-

pared them for being in the field for the length of time involved at the NTC.

The task force commanders for Rotation E cited the lack of time to train outside the formal evaluation setting. One said, "(a hinderance to training) is lack of time to go out and give to a company commander some maneuver . . . area and time to just work with his platoons by himself." The other said, "I went straight into the task force evaluation without the opportunity to do anything, formations, or movement or any of that jazz." He reported that the only time he had to plan activities on his own was during the NTC Tactical Exercise Without Troops (TEWT).

The brigade commander for Rotation I described a training schedule that left little or no time for retraining in deficient areas: "We did some imaginative training to do all the things that we did in six weeks. My staff will tell you that they didn't think it was possible. There was one week we had company training, a river crossing exercise, the end of gunnery. . . . I tore them every way but loose. My argument was that if you guys can learn to handle multiple things simultaneously, the desert will be a piece of cake. They said, 'Yeah, o.k. Colonel. So be it.'" This is another example of focusing on presumed NTC conditions and standards, rather than on the unit's METL.

In contrast, the division G3 for Rotation J described how the division consciously plans time for remedial training: "There is a one- or two-week time period where the units can turn around and go back out into field and retrain those events they saw they were weak on before they have to come in and load the train and deploy out. . . ."

The Armor task force commander for Rotation J described a plan to permit training and retraining before a formal evaluation: "We had . . . about two weeks . . . where each platoon got to go through each lane in a learning mode. If they didn't do it right, they did it again. . . . So we spent two weeks of that, and then the last week, I brought in a different set of O/Cs, (to act as) external evaluators. . . . And that was well received by the platoon leaders. The company commanders thought it was some of the best training the platoons had ever gotten. . . ." Group interviews confirmed that the time to correct weaknesses in the field was a positive aspect of this training. The groups from the mech infantry task force were less positive,

citing a lack of time for a complete training, evaluation, and retraining cycle.

Rotation D, the rotation with the highest rated NTC performance, planned its training to include time for retraining. Overall, respondents to group and individual interviews said that the pace of this training was good. Table 5 contains the schedule for the Company ARTEPs for this rotation, showing that there was time programmed for training prior to the formally evaluated exercise, which was followed by time to retrain, if needed. The brigade commander said that having training time in the middle of the exercises was better than doing ". . . event after event, after event, after event." He said he would have liked another training period like that, "Maybe not full up with O/Cs everywhere, but more company-team training."

Table 5
Schedule for Company-Team ARTEPs, Rotation D

Day	Event
1	Prepare and deploy to training area.
2	Company-team training in training area.
3	Advance guard and prepare for DIS.
4	Prep for DIS in AM; DIS in PM.
5	OBBD in AM; Target acquisition in PM.
6	Train in AM; Prep for DIS in PM.
7	DIS in AM; Train in PM.
8	Train in AM; Prep for DATK in PM.
9	DATK.
10	Train in area.
11	Redeploy to garrison/maintenance.

DIS: Defend in Sector DATK: Deliberate Attack OBBD: Obstacle Breaching Drill

Summary of Findings About Execution of Training

The units examined varied considerably in determining what training the subordinate elements needed, in providing time to train prior to formal evaluation, and in providing time to retrain to address weaknesses. Some units did all of these things better than others. The difference seems to be that some units planned for these activities while others did not. When

the activities were planned, they were also resourced. The other units relied on "hip-pocket" strategies that were not deliberately scheduled or resourced.

EVALUATION OF HOME-STATION TRAINING

The Army describes standards for the performance of tasks in its ARTEP/MTP Training and Evaluation Outlines (T&EOs). It is important to use these standards to ensure that, throughout the Army, collective training addresses the "common procedures and uniform operational methods" found in Army doctrine. Previous sections of this paper have shown that home-station training is oriented to missions and BOSs, rather than to tasks. This makes evaluation of home-station training difficult because there is little guidance about the standards to apply to missions or BOSs. The findings in this section are concerned with the extent to which units applied training standards at home station that were consistent with the standards operating at the NTC. Four findings will be discussed:

- Standards vary from division to division and over time.
- Leaders do not find it easy to establish or enforce "training gates."
- Leaders report that training standards at the NTC differ from home-station standards.
- Home-station training does not permit replication of NTC conditions, frustrating efforts to apply Army standards.

Standards vary from division to division and over time. One task force commander from Rotation E said, "We got a new commanding general, we got a new ADC-M, so I'm not really sure what they judge as a success." "If . . . we do learn from our mistakes and come back at a much higher level of training (after the NTC), then that's one measure of doing well." The other task force commander from this rotation also considered improvement to be the standard: ". . . I want to get a little better each day. If we did two stupid things on Monday, I'd like to do at least *two different* stupid things on Tuesday, or *one fewer* stupid thing on Tuesday. . . ." Post-NTC, both the commander and S3 of one of the task forces agreed that training would be improved by setting standards and enforcing them.

The Armor commander for Rotation A offered four alternative definitions of success at NTC:

- BLUFOR kills more systems than OPFOR.
- Task force accomplished mission assigned by brigade.
- Performed MTP tasks to standard.
- Learned from mistakes—didn't repeat them.

His S3 apparently felt that there was no way to perform to standard on defense at NTC, saying that mission was a "no-win situation" for the BLUFOR. The S3 for the Mech Infantry in this rotation said, "Winning to me would be one mission where . . . we complete the mission and we still have adequate combat power to continue." He describes changing the standards he set over time to match a crawl-walk-run sequence with a goal of being able to succeed at the NTC.

The S3 of one task force from Rotation C illustrated the problem of changing standards: "We would show up and we would execute the training and sometimes we would get the word of . . . exactly what the rules of the game or the standards were the day of execution. . . . That kind of hindered us."

The brigade commander for Rotation I apparently confused knowledge of the standards with performance to standard: ". . . one of the lessons that came out of the last drill out in the desert was that you start the day with the standards you are going to have for that day . . . you have a very vigorous stand-to—something our Army has forgotten—which means everything is loaded, soldiers are ready to go to war, then that sets the tone for the whole day and it sets the standard. Therefore, precombat inspections make certain that everybody's got the standard and we whip up on them big time. I just turn my Command Sergeant Major (CSM) loose. He has a great time. Then we give them a written test on rules of engagement so that they know the rules."

Leaders do not find it easy to establish and enforce "training gates." The lack of clear standards noted above is especially true for force-on-force engagements. Consequently, units do not have fixed standards of performance that must be attained before the unit moves to the next (more complex) training event.

Units appear to pay more attention to the standards that accompany various live-fire exercises (such as the various "tables"). Rotation A, for example, refired 23 Bradley and 24 M1 crews (across two task forces) because turbulence meant that those vehicles were not manned by qualified crews. However, the S3 for the Mech Infantry on that rotation stated that *none* of the Bradley crews qualified on Table XII, but that did not prevent them from participating in the Combined Arms Live Fire Exercise (CALFEX) or going to the NTC.

The brigade commander from Rotation D gave an example of setting a "training gate." He required the battalions to train their personnel in the use of the MILES system before they started the company-team ARTEP (described earlier). This was a modification of a previous training program in which there was a separate MILES gunnery exercise within the ARTEP. This commander thought that this was redundant, because all of the other exercises incorporated MILES.

Leaders report that training standards at the NTC differ from home-station standards. The Army has established standards for task performance in the ARTEP/MTPs. However, the units do not use these to guide training, or as a tool for evaluating performance at home station. Unfortunately, the NTC does not explicitly use these standards in the Take Home Package or AAR materials that are sent to the home station after a rotation. This makes it difficult to assess the comparability of the standards.

The Armor task force commander from Rotation A said, ". . . engineers started getting taken out by artillery (at the NTC) faster than we had ever trained for (at home station)." After his seconds experience at the NTC, in Rotation G, he said the OPFOR was even more successful, ". . . if we were attacking, and before we got into their direct fire killsacks, we might lose one vehicle to artillery or air (Rotation A). Where for (Rotation G) out of a task force, 12 vehicles would not be unusual to lose." The brigade commander from Rotation G also said that the artillery was overwhelming, ". . . I think there's a teaching point like everything else at the NTC . . . but it's to the extreme. . . ."

One task force commander from Rotation E said that the two force-on-force O/C teams at the NTC use different standards for reconstitution: "The Cobra O/C team (armor task forces) believes in unit reconstitution because you get soldiers

back to train. Scorpion O/C group (mech infantry) says, "You are going to do individual reconstitution. If the wounded aren't handled properly they will die . . . and you will lose them for the next battle."

The commander of one task force from Rotation E said that the missions at the NTC are not good representations of what the units would actually be asked to do in combat. He felt they were too taxing and that the rules of engagement were not realistic. In particular, they do not permit BLUFOR to recon as well as they could under real circumstances; the poor state of the vehicles at the NTC does not permit maintenance units to attain acceptable readiness rates; and casualty exchange ratios (a measure of performance) are pointless because the NTC OPFOR continues to fight long after they would have retired from real battles.

The brigade S3 for Rotation E learned a lesson about nuclear, biological, and chemical warfare (NBC): "At (home station) you can kind of blow NBC off or do minimal. Out there (NTC) it's much more critical." "NBC officers need to be much more aggressive about selling their product, about standing up and saying, 'I need to be involved in the planning process.'"

Rotation G had a particular problem with the pacing of the exercises at the NTC. The group interviews revealed that they had not trained for the NTC's fast pace and high degree of stress. The one task force commander who had also participated in Rotation A thought that they had trained to the pace and stress NTC had used in Rotation A, and that the standard had been changed. This was particularly disappointing to him because he had incorporated training in the use of a synchronization matrix at the suggestion of the NTC O/Cs, and he felt that his orders process took longer than before as a consequence of this additional requirement.

The Mech Infantry commander from Rotation A did not agree with everything the O/Cs said about his unit, and he dismissed some of it on the grounds that "Tactics are different for everybody . . . everybody has a different way of fighting a battle." He also found that the NTC has "some great literature on how to organize a defense." But it was different from "the way we normally run our business" and they were not able to absorb and apply it during the rotation. The implication is that the NTC is teaching something different from the doctrine prac-

ticed at the home stations. This impression seems to be confirmed by one of the task force commanders from Rotation G, who stated that he had set up a defense in the way he had been trained, but the O/Cs had criticized this formation.

Home-station training does not permit replication of NTC conditions, frustrating efforts to apply army standards. Often, when leaders report that NTC standards differ from home-station standards, they mean the *conditions* of performance rather than the standards. NTC conditions are regarded as more demanding than those at home station. The NTC may be the only maneuver area in which it is possible to realistically portray certain conditions—an entire BLUFOR brigade in conflict with an OPFOR regiment, with all the associated artillery and air, etc. In the following paper, under the principle "Train as you Fight," we will present information which suggests that the three divisions involved in this research did not support fully realistic exercises. Whether because the facilities are too small, or because there were insufficient resources to allow for realistic battle play, leaders of BLUFOR units simply may not have the experience to judge whether these conditions are realistic or excessive. To the extent that the NTC represents realistic conditions, the inability to replicate those conditions at home station means that units cannot accurately evaluate themselves with respect to Army standards.

Summary of Findings About Home-Station Evaluation of Training

Home stations do not consistently use the standards set forth in ARTEP/MTP T&EOs. The NTC does not reinforce the importance of task-based standards because it uses a BOS and mission-oriented format for reporting performance evaluations. Home stations do not fully support training of larger units in doctrinal formations. This means that home-station commanders cannot accurately evaluate themselves with respect to Army standards because they are unable to replicate the applicable conditions. Some leaders feel that the NTC conditions are more rigorous than those specified in Army doctrine, or likely to be required in actual combat, but they may not have enough experience to judge this well.

SUMMARY OF FINDINGS FOR THE TRAINING MANAGEMENT CYCLE

Figure 3 summarizes the degree to which the seven rotations we examined applied the training management cycle described in FM 25-100. Each rotation was rated as to whether it exhibited low, moderate, or high application of the Army's guidance for each phase. The following guidelines were used to perform the rating for each phase:

METL Development:

Low application:	MTP tasks make up less than 30% of METL
Moderate application:	MTP tasks make up from 31% to 70% of METL
High application:	MTP tasks make up 71% or more of METL

Figure 3. Implementation of the training management cycle by the rotations studied in the Determinants of Effective Performance research project.

	ROTATION						
TMC Phase	D	A	J	C	E	G	I
METL Development	◔	◔	◔	●	◔	●	◔
Planning	○	○	◔	◔	●	◔	●
Execution	○	●	●	◔	◔	◔	●
Evaluation	◔	●	○	◔	◔	◔	◔
FOF Successes	5	3	2	2	1	1	0
Casuality Exchange Ratio	0.87						0.52

○ High Application ◔ Moderate Application ● Low Application

Planning Training:

Survey responses concerning schedules, distracters and resources were converted into high, medium and low ratings and then combined to produce the ratings shown.

Execution of Training:

Survey responses concerning opportunities to correct weaknesses, and practicing basics before advanced skills were converted into high, medium, and low ratings. These were combined with ratings of execution provided by two Subject Matter Experts (retired Army Colonels with combat and training experience) to produce the ratings shown. Using documentary evidence as well as group and individual interviews, the Subject Matter Experts rated the effects of training management practices on combined arms training, the realism of training, and the pace of training.

Evaluation:

The Subject Matter Experts evaluated documentary evidence as well as group and individual interviews, looking at assessment in general. They considered six aspects of assessment, phrased as questions:

- Was an evaluation plan developed?
- Were the adjustments made to ongoing training based on revised commander's assessments?
- Were O/Cs experienced and trained?
- Was evaluation based on clearly defined Army standards (e.g., ARTEP (Army Training and Evaluation Program)/MTP (Mission Training Plan), T&EOs (Training and Evaluation Outlines))?
- Did the units use the NTC Take Home Package?
- Did the units use the CALL Lessons Learned?

The answers were combined to produce the ratings shown in Figure 3.[5]

The patterns in the Figure indicate that the application of FM 25-100 guidance concerning the training management cycle is related to subsequent NTC performance. While the relationship is clear, it is however, not a direct, one-for-one relation-

ship. There are clearly many weak points in the application of the guidance.

Notes

1. The other Principles of Training are discussed in the following paper.

2. Page numbers are from FM 25-100.

3. Each of the three divisions examined had one additional rotation during either fiscal year 1989 or fiscal year 1990 in which two of the battalions in a brigade were on the sidelines while the third battalion was prepared to rotate with a National Guard unit.

4. The exception to this rule was Rotation G, which deferred several quarterly training briefings on the grounds that there was no change in training status to report.

5. The combining rule was, If the number of positive answers exceeds the number of negative answers by two, score the rotation as "high application"; if the number of negative answers exceeds the number of positive answers by two, score the rotation as "low application"; otherwise score the rotation as "moderate application."

Application of the Principles of Training in Armor and Mechanized Infantry Units

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INTRODUCTION

This paper examines the nature of the training that was provided to the units at their home stations and the relationships that were found between that training and unit combat capability as demonstrated at NTC. The paper is structured according to the Army training doctrine as stated in FM 25-100, Training the Force. The major principles of training in FM 25-100 are

- Train as Combined Arms and Services Team
- Train as You Fight
- Use Appropriate Doctrine
- Use Performance-Oriented Training
- Train to Challenge
- Train to Sustain Proficiency
- Train Using Multi-Echelon Techniques
- Train to Maintain
- Make Commanders the Primary Trainers

The data collected in this project allowed an assessment of the degree to which five of these were applied by the studied units, and with what result. The five assessed were

- Train as Combined Arms and Services Team
- Train as You Fight
- Use Performance-Oriented Training
- Train to Sustain Proficiency
- Train to Maintain

Each of the five principles is discussed in a separate section of this paper. The paper concludes with a summary chart that relates implementation of the Principles of Training to performance at the NTC.

TRAIN AS A COMBINED ARMS AND SERVICES TEAM

FM 25-100 stresses the importance of training to enable troops to engage in combined arms and services operations as soon as they are committed to battle: "When committed to battle, each unit must be prepared to execute combined arms and services operations without additional training or lengthy adjustment periods." "Leaders must regularly practice cross attachment of the full wartime spectrum of combat, combat support, and combat service support units." (p. 1-3)

Although the discussion of this principle in FM 25-100 emphasizes brigade and higher echelons, it is clear that Army doctrine applies this concept at lower echelons, as well. For example, Army Mission Training Plans (MTPs) at the Brigade, Battalion/Task Force, and Company/Team levels are written for combined arms units. Information gathered in this project examines two specific issues for combined arms training:

- How extensively should cross-attached companies and platoons be trained to develop proficient combined arms teams?
- What impact does battle staff training involving the slice elements have on performance?

Training Maneuver Units in Cross-Attached Configurations at Home Station Benefits Performance

With respect to maneuver elements, we observed several variations on two basic patterns of organization:

- The Modified Table of Organization and Equipment (MTOE) for Combined Arms Maneuver Battalions (CAMB) integrates Armor and Mechanized Infantry companies into a combined arms task force. They may or may not cross-attach platoons within the task force to form combined arms teams.
- Other Brigades cross-attach companies from one battalion to another to create combined arms task

forces and cross-attach platoons in the new configuration to form combined arms teams.

- Another organizational variation is found in the employment of battalions left at home station.

Since each brigade sent two combined arms task forces to NTC, there was a third battalion left at home station. Sometimes this battalion contributed units to the NTC-bound task forces. This battalion maintained its MTOE organization throughout the training period—it did not practice as combined arms teams. When a battalion that was not participating in the rotation contributed units to the task forces that were participating, the contributed units often reported that full control was not passed to the receiving task force. As a result the contributed units received conflicting directions from the task force and their MTOE battalion. Instances of this problem are noted in the text describing each rotation.

In general, the battalion that was left out of one rotation would participate in the subsequent rotation assigned to that brigade, so for non-CAMB units the task force organization only exists for the NTC train-up period. None of the non-CAMB units we observed maintained their company-team cross attachments after they returned from NTC. To the extent that non-CAMB units are defined by their particular combined-arms SOP and the particular persons implementing it, those units no longer exist after NTC. Among CAMB units, none maintained the platoon-level cross-attachments; they returned to pure companies after NTC.

The task force organizations that were employed in each rotation are diagrammed in Figure 1. This figure shows that each task force in a rotation has a 'letter code' that indicates the rotation and the type of unit. For example, TF-A is the Armor task force of Rotation A, while TF-a is the Mechanized Infantry task force. These letter codes will be used in subsequent figures. TF-e and TF-g were also Armor task forces; these rotations did not include an Echo Company.

Figure 1 also contains indications of how long the units trained together in the configuration used at NTC. Some units cross-attached companies and/or platoons for field exercises only, while others cross-attached in garrison as well as in the field. Among those also cross-attaching in garrison, some were thorough cross-attachments, while others were partial. These

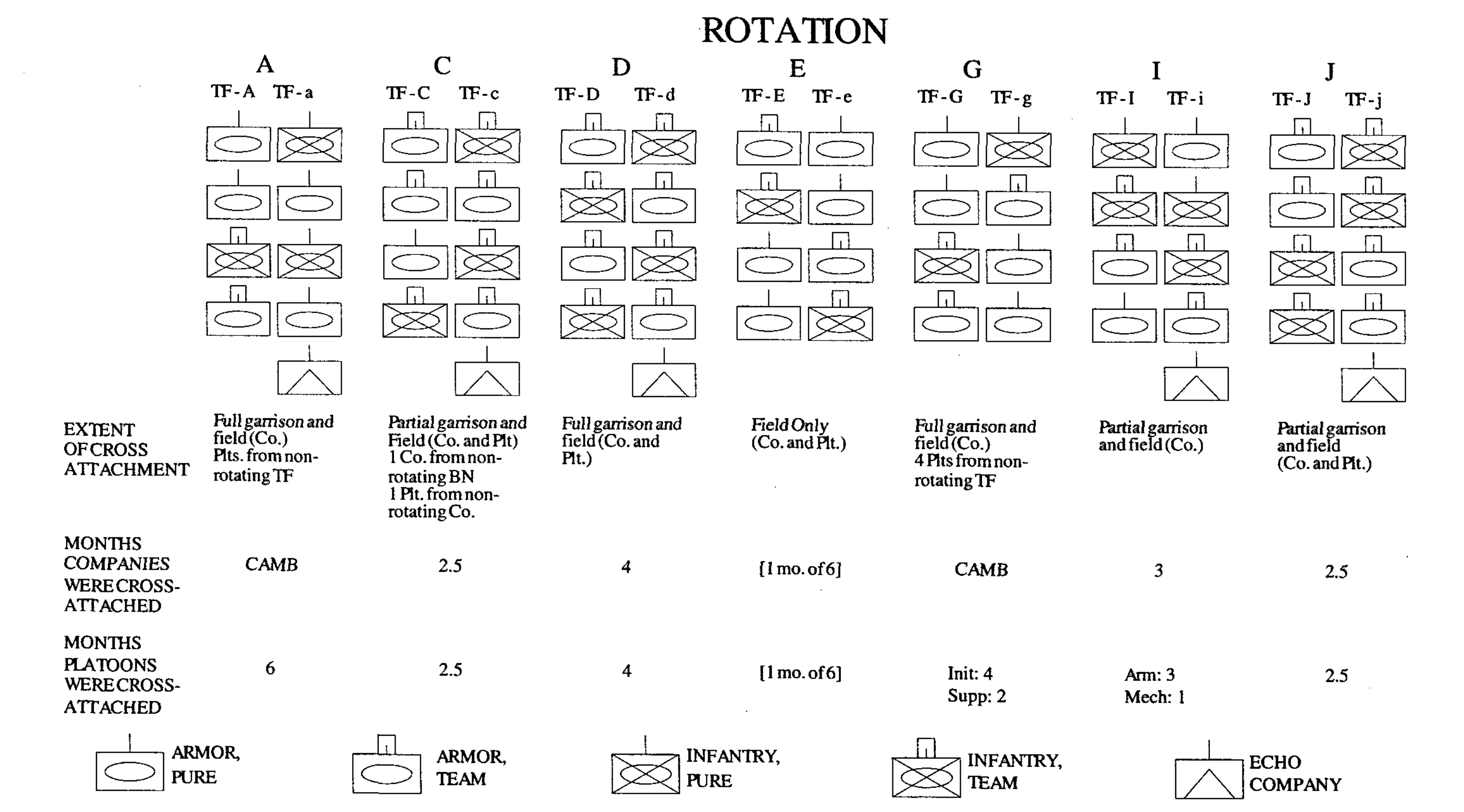


Figure 1. Task force organization by rotation.

variations are indicated in Figure 1 and described more fully in the following text.

Rotation D, which had the highest level of NTC performance of units examined, cross-attached companies from the two participating battalions about four months prior to NTC for home-station training. At this time they also formed combined arms teams by cross-attaching platoons. This move was made after platoon ARTEPs,[1] prior to company field training exercises (FTXs). This cross-attachment included garrison activities such as personnel standing formations, doing physical training (PT), and attending classroom training with their new unit. In addition, vehicles and platoon equipment (camouflage nets, etc.) were moved to the appropriate motor pool. This was a more thorough cross-attachment than other non-CAMB rotations (where cross-attachment was normally limited to field exercises) and was comparable at the task force level to the cross-attachment that characterizes CAMB units. At the company/team level the degree of cross-attachment exceeded that found in other CAMB units.

The structure of Rotation D was also unique in that the two battalions came from different brigades. Staff in the battalion that was not originally from the brigade controlling the rotation reported instances of conflicting demands from its MTOE brigade.

Rotation A, which had the next highest performance at NTC, was formed of CAMB units. Data collection for this rotation (the first in this phase of the project) was limited and contains no information on the cross-attachment of platoons prior to NTC. At NTC, one task force used several different platoon cross-attachments, while the other primarily used one. The brigade commander gave two reasons for preferring the CAMB organization: 1) ". . . because this outfit is CAMB already . . . the Armor commanders at the task force level . . . know how to employ infantry." 2) ". . . all the mechanics know something about everything."

Rotation C cross-attached companies and platoons prior to their combined platoon/ company situational training exercises (STXs), about 2.5 months prior to NTC. This rotation also took one company from their nonrotating battalion. Rotation J cross-attached at about the same time interval prior to NTC, but did not take elements of nonrotating battalions. Individual

and group interviews indicated that the personnel from the nonrotating battalion in Rotation C were affected by conflicting demands from the task force leadership and their MTOE battalion leadership (which retained responsibility for the Officer Efficiency Reports).

Rotation E was composed of two Armor task forces that took one company of infantry each from a nonrotating battalion. Cross-attachment involved relocating only two platoons in each task force to make up two combined arms teams, leaving two pure Armor teams in each task force. This cross-attachment occurred only during the company/team FTX and the task force FTX; all other training took place in 'pure' configurations. Once again, the companies from the nonrotating battalion experienced conflicting demands from their MTOE battalion.

Rotation G was composed of two Armor-heavy CAMB battalions. Each one cross-attached one Mechanized Infantry platoon and one Armor platoon to form two combined arms teams about four months prior to NTC. However, about two months prior to NTC one pure Armor company in each task force was required to substitute an infantry platoon from a nonrotating battalion for one of their Armor platoons. Commanders reported having difficulty integrating these units into effective teams during the company STX and task force FTX. The Armor task force commander said, ". . . (the Armor company commander) has a new challenge. He's not familiar with Mechanized Infantry; so right now he is trying to integrate that team-level effort so that he knows what his real capabilities are. What can the platoon do for him, what are the limitations?"

Rotation I, which had the lowest level of NTC performance, cross-attached companies about three months prior to NTC. They took one Armor company from a nonrotating battalion. However, one task force did not determine how to cross-attach platoons to form combined arms teams until just before NTC.

After NTC, leaders were asked to judge whether home-station training was as realistic and demanding as the training at NTC. The judgments concerned several aspects of home-station training, among which was training as combined arms teams. Task force commanders and S3s did not differ from rotation to rotation, and gave this aspect of home-station training the

most positive rating of all. Platoon leaders also did not differ among rotations, and judged this aspect of home-station training to be very similar to NTC. Company commanders indicated that this was the aspect of home-station training most like NTC training, but they distinguished among rotations. Rotations A, C, D, and G were judged to be at least as realistic and demanding as NTC (the top point on the scale of judgment), while Rotations E and J were judged to be less realistic and demanding (the middle point of the scale), and Rotation I was placed in between these extremes. Rotation E was probably judged to be low because they only cross-attached during field exercises. Rotation J was probably judged to be low because they cross-attached late.

Although Rotation D had extensive opportunities to train in the cross-attached mode, their senior leaders indicated that it was difficult to learn how to fight that way. Prior to NTC, the brigade commander expressed his concern that his units did not know how to employ dismounted infantry: "We're still new in the Bradley world so I think we're still mesmerized somewhat by the machine . . . but we can't be successful if we don't have dismounts. I'm convinced of that." The Armor task force S3 commented, "At . . . company level, I would say I don't think we've broken the code yet on dismount operations. Dismounting people, then remounting them, maintaining command and control. . . . It is just tough stuff." Given these comments, it is easy to see that units providing less opportunity for cross-attached training would have even greater difficulties.

Battle Staff Operations Are Correlated With NTC Success

In the following analyses the task forces in each rotation are considered separately. In addition to the ratings of overall mission performance, the Observer/Controllers at NTC also rated the battle staff of each task force on a set of items. The items were derived from conceptual work by Olmstead, Christensen, and Lackey (1973).[2] For analysis, the items were grouped into three constructs:

- **Staff Integration:** Obtaining and sharing information among staff, making staff decisions, and performing as a team.
- **Order Quality:** Timeliness and doctrinal soundness of orders.

- **Staff Monitoring:** Communicating instructions, tracking actions, and adjusting plans.

For each task force, the value for each of these constructs is the average of the O/C ratings on the items in that construct across all force-on-force missions.

After NTC the task force commander and his primary staff (XO, S1, S2, S3, S4, and S3-Air) rated 37 aspects of the staff's performance. These items were derived from a structured interview developed by officers at CALL. The items were grouped into seven constructs:

- **Staff SOP and Training:** Standing Operation Procedures (SOP) and exercises prior to NTC.
- **Organization of Tactical Operating Center (TOC):** Use and monitoring of staff action matrix, and TOC shifts.
- **Orders Process:** Troop leading procedures, decision-making process, clarity and checking of commander's intent, and "war gaming."
- **Order Quality:** Soundness and timeliness of orders.
- **Staff Monitoring:** Staff rehearsals, tracking battles, and modifying orders.
- **Subordinate Commanders' Implementation:** Back-briefs, rehearsals, and keeping staff informed.
- **Integration:** Integration of slice representatives; obtaining, sharing, and interpreting information; and cooperation.

For each task force, the value for each of these seven constructs is the average of the ratings of the relevant items by the task force commander and his primary staff.

The relationships of O/C ratings of staff operations and force-on-force success with the staff ratings of battle staff operations are shown in Table 1. The correlations show that battle staffs tended to agree with O/C assessments of staff performance, principally with regard to staff ratings of SOP/Training and orders quality. On the other hand, TOC operations (task matrix and shift coordination) are not related to any O/C measure and subordinate commanders' implementation is not related to O/C ratings of staff operations.

Table 1
Correlations of O/C Ratings With Staff Ratings of Battle Staff Operations

	Staff Ratings After NTC						
OC Ratings	**SOP/ Training**	**TOC Operations**	**Orders Process**	**Order Quality**	**Staff Monitoring**	**Subordinate CDRs' Implement.**	**Integration**
Integration	.71**	-.07	.54*	.26	.29	-.08	.47*
Order Quality	.63*	-.06	.83***	.26	.20	.19	.34
Staff Monitoring	.58*	-.03	.54*	.19	.27	-.10	.39
FOF Success	.71**	.14	.03	.48*	.27	.45	.70**

* Significance = .05 ** Significance = .01 *** Significance = .001 N = 14 Task Forces

Three constructs were rated by both O/Cs and staffs: Integration, order quality, and staff monitoring. Though both sets of raters tended to agree, only the correlation for integration was significant.

Three of the relations in Table 1 are especially strong: Force-on-Force (FOF) success with integration, FOF success with SOP and training, and order quality with orders process. These findings are examined in the remainder of this section.

- Staff integration is related to task force success.
  - Having a Captain as S2 is demonstrated to work better than having a First Lieutenant.
  - Higher performing staffs agree about who served as primary staff supervisor.
  - Providing opportunities to train with slice elements was a problem.
- Staff SOP and training set the framework for task force success.
- Order quality is related to the decision-making process.

Staff Integration Is Related to Task Force Success

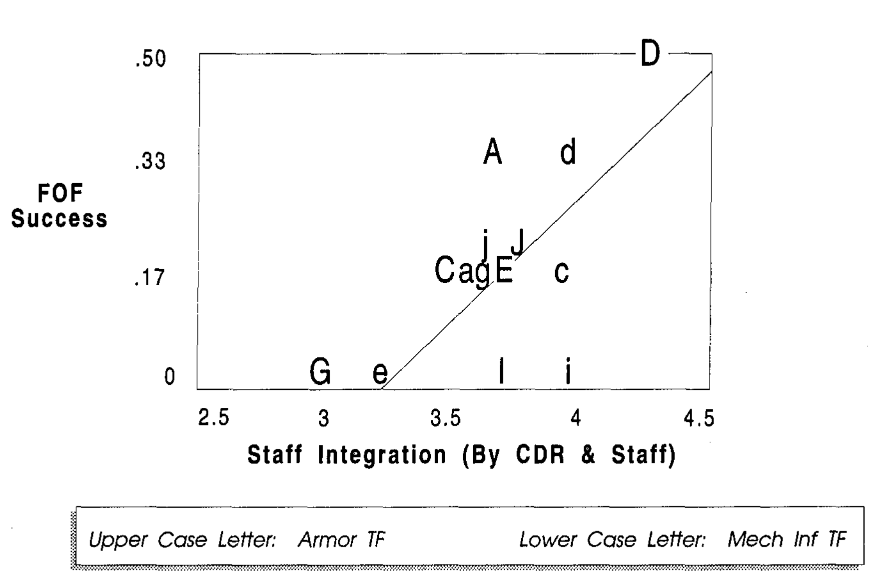
As shown in Table 1, O/C ratings of success are strongly related to staff integration as reported by the commander and

staff. The items for the commander and staff addressed cooperation among all staff members, including slice elements (which were the Engineer, Air Liaison Officer, and Fire Support Officer). The relation between integration and success is shown in Figure 2. In that figure, success is shown as the proportion of successful force-on-force missions; integration is the mean rating of items in the construct on a scale from 1 to 5:

Code	Response
1	Strongly Disagree
2	Disagree
3	Neither Disagree Nor Agree
4	Disagree
5	Strongly Disagree

Each letter in the figure represents one task force from one rotation. The upper-case letters represent the Armor task force, while the lower case letters represent the Mechanized Infantry task force (except for Rotations E and G, which had two Armor task forces). The composition of these task forces is shown in Figure 1.

Figure 2. Relationship between NTC performance and battle staff integration.



Army guidance stresses the importance of gathering and sharing information.[3] "The unit TOC must forward concise reports to the commander on information gained from higher and adjacent units." The correlations of staff ratings of items related to staff integration with O/C assessments of performance support this guidance. The item "Attempts made by the staff to obtain relevant information were appropriate and effective" correlated .69 (p<.01) with mission performance and the item "The staff effectively shared relevant information that was available throughout mission performance" correlated .66 (p<.01).

Having a Captain as S2 works better than having a First Lieutenant. The CALL compendium of lessons learned (CALL: *Year of Training, Volume 1: Heavy Forces,* 1988) describes the S2 as the "key" to the process of gathering and forwarding information. The experience of the task forces in this study confirm that assessment and illustrate the importance of experience in that position. The Army Tables of Organization and Equipment for the units participating in the project specify that the S2 should have the rank of Captain. However, only six of the task force S2s were of that rank, the other eight were First Lieutenants. As shown in Table 2, the task forces with Captains in the role of S2 had more than twice the success rate of the task forces with Lieutenants in that role (P=.035). The O/Cs also gave the task forces with Captains as S2s higher ratings on the three-point scale for staff integration (p=.042).

Table 2
Success and Staff Integration by Rank of S2

S2 Rank	Number of TF	TF Success	Staff Integration
CPT	6	.25	2.0
1LT	8	.10	1.5

Higher performing staffs agree about who served as primary staff supervisor. Doctrine states that the XO should be the supervisor of the staff. Staff members indicated, after NTC, that several different staff members served in this role, most notably the S3 and the S3-Air. Examining the responses of the

XOs and S3s in 11 task forces where both responded to the surveys revealed only modest agreement about who had, in fact, been primary staff supervisor: 8 times out of 11 they agreed on who served as primary staff supervisor during the planning phase, but they only agreed 5 times out of 11 on the preparation phase and 7 times out of 11 on the execution phase. The three task forces that performed best (D, A, and d) usually agreed (66% agreement), while the four that were least successful (e, G, I, and i) usually disagreed (33% agreement). It seems that clarity about who is supervisor is more important than having the XO in charge. In particular, the S3 or S3-Air supervised the planning and preparation phases for the three most successful task forces participating in the project.

Providing opportunities to train with slice elements was a problem. Including slice elements is important to training because such assets are critical to success on the battlefield. For example, one brigade S3 estimated that the brigade-controlled assets (helicopters, artillery, etc.) must inflict 20-35% casualties on the OPFOR to enable the BLUFOR to succeed. Yet, in all rotations examined, units experienced obstacles that impeded integrated training with their slice elements.

The brigade commander from Rotation D, the highest performing rotation, indicated that he was fortunate to have a Division Support Battalion (DSB) that had gone to NTC recently and had retained much of the same leadership from that time. He said, "They know how to make the CSS (Combat Service Support) systems support maneuver commanders." However, he reported a problem with training Air Liaison Officers who were only able to come to the home station a few days before the rotation at NTC. During the rotation they were unable to be confident that aviation was coordinating properly with other assets.

Leaders from Rotation A thought they had trained sufficiently with the engineers, but had little opportunity to train with aviation and air defense units. The Armor task force commander said that he thought the engineers were "just like one of my other companies." The Mechanized Infantry commander stated that aviation "popped up on my net without warning" during the one training exercise and neither knew the other's call signs. The brigade S3 said the Combined Arms Live

Fire Exercise (just prior to NTC) was the first time all slice elements were present. After NTC he cited a specific problem: At the last-minute a Cavalry troop that had not trained with the brigade was added to the rotation.

Leaders of Rotation J indicated that they had little opportunity to work with aviation, either as enemy or friendly. The Air Force had to cancel out of the schedule for Company-Team STXs and they were only available for two days during the brigade ARTEP, during which time they were friendlies. As to air defense the brigade S3 said, before NTC, "We've TOC'd it, we've planned it, we've rehearsed it, we've done everything we can without having the A10s come in against us." He also indicated that the training of the CSS portion of the staff was not fully realistic: ". . . it was not supporting the battalion task force in the way they would have done at NTC . . . because the . . . Forward Support Battalion was not in the field."

Leaders in Rotation C indicated that the slice elements were not brought into the training early enough to have them participate meaningfully in developing command and control SOPs. The first time they met was at the start of field exercises.

Rotation E was provided with an artillery battalion from a different post. The commander of this battalion had visited the home station once, but the artillery battalion had never trained in the field with the brigade.

Rotation G was given an engineering company from the Corps because the division's engineer assets were exhausted from having supported other NTC rotations during the year. This engineering unit was not equipped to do the tasks required of them, and had never trained with the brigade. This brigade was not able to do field training for a long period because of lack of funds. Though battalions could have conducted staff exercises (in the field or with simulations) with the slice leaders during that time, staff training occurred during the compressed field training schedule at the end of the training period.

One task force commander of the lowest performing rotation thought that he did not need to stress combined arms operations: "I do not get misoriented by everyone forcing synchronization, with all the artillery, and air defense down my throat. The bottom line is . . . I could win (at NTC) . . . if you give me no air defense, engineers or artillery . . . if everything is

done to standard with the maneuver, command and control, and direct fire. I cannot win if I put all my emphasis on artillery, engineers, and air defense. . . . And that's heresy. I have to be very careful how I package that."

Staff SOP and Training Set the Framework for Task Force Success

An SOP helps to control the confusion of the battlefield. As one task force commander put it: "NTC . . . is a different terrain, a different environment, a different enemy from what we were used to fighting, and so conducting our business the way we had trained, that took some of the unknowns out of it. And then we were able to concentrate just on those variables that were, in fact, different out there." The lack of an SOP makes it hard to hold units to a standard of performance. One task force commander reviewing his unit's NTC performance said, "They did not have an SOP. Every time they issued the order to a platoon they didn't have a standard for . . . (road march, or employment circumstances or formations). Of course the soldiers didn't know either."

However, it takes time to develop an SOP; and refinements to it must be based on feedback from realistic exercises that highlight its strengths and weaknesses. One S3 emphasized the need to train in the execution of the SOP, ". . . the staff has to pull together and do that integration and . . . that kind of magic doesn't happen by saying, 'Here is your SOP, I want you to read this, and in one week or two weeks do this kind of thing.' It's something that has to be worked at to happen." There was evidence in the interviews with senior leaders that SOP development and refinement needed attention.

The brigade commander of Rotation D described an approach to training in the SOP using orders processing drills to be sure that they could issue orders from brigade through platoon in accord with the 1/3–2/3 rule. These drills appear to have benefited this brigade.

In Rotation A, the last-minute addition of the CAV troop caused both task force commanders to wonder how it would be controlled—implying there was no SOP. One task force commander said that neither he nor his aviation counterpart knew their call signs or what information to exchange (during home station training). The brigade S3 indicated (after NTC) that they

did not have an SOP for passing one task force through another. One task force commander indicated that they changed their air defense SOP through the course of the NTC rotation.

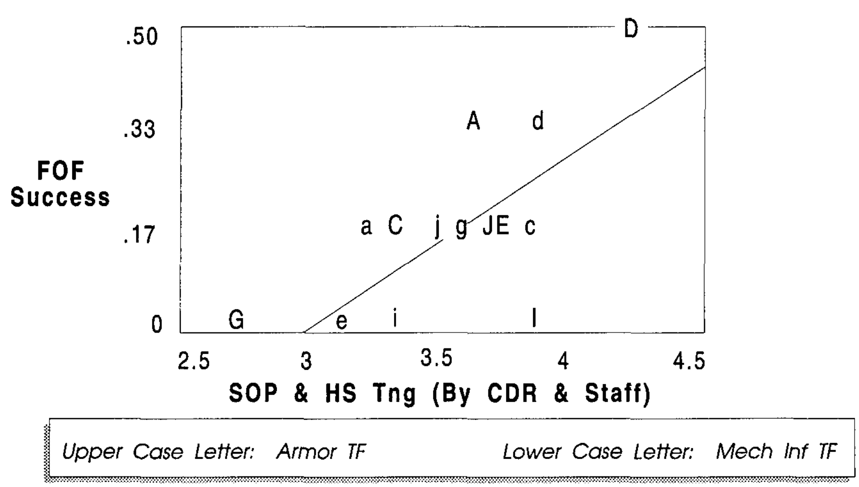
Senior leaders in Rotation E indicated that their orders-producing SOP was still being developed after NTC and that their SOP for artillery fire priorities did not work properly.

One task force commander in Rotation G indicated that there were two SOPs: a written SOP and the "real SOP which is . . . what we do day after day after day."

The plot in Figure 3 shows that staff ratings of the extent that they had trained to an established SOP were correlated highly (r=.71) with O/C ratings of performance. The staff ratings were on a five-point scale reflecting levels of agreement to a series of statements regarding the establishment of an SOP and the extent of training to it. The possible responses to theses statements were

Code	**Response**
1	Strongly Disagree
2	Disagree
3	Neither Disagree Nor Agree
4	Agree
5	Strongly Agree

Figure 3. Relationship of NTC performance to SOP and training.



The responses to the statements were combined into an overall score ranging from 1 (reflecting a response of "Strongly Disagree" to all of the items) to 5 (indicating a response of "Strongly Agree" to all of the items).

As seen in the figure, the main exception to the relationship between SOP development and training with NTC performance was the task force designated with the symbol "I." That task force considered itself to be well trained on its SOP, but was rated among the least successful by the O/Cs. The results on order quality (presented next) indicate that this task force may indeed have had a well-practiced staff SOP. However, it appears that an established SOP is a necessary but not sufficient condition for superior NTC performance. Other information in this paper indicates that this task force suffered problems in a number of other areas, such as a less complete application of the Training Management Cycle and a lower application of the Principles of Training, and such deficiencies appear to have outweighed the benefits of its training in a staff SOP.

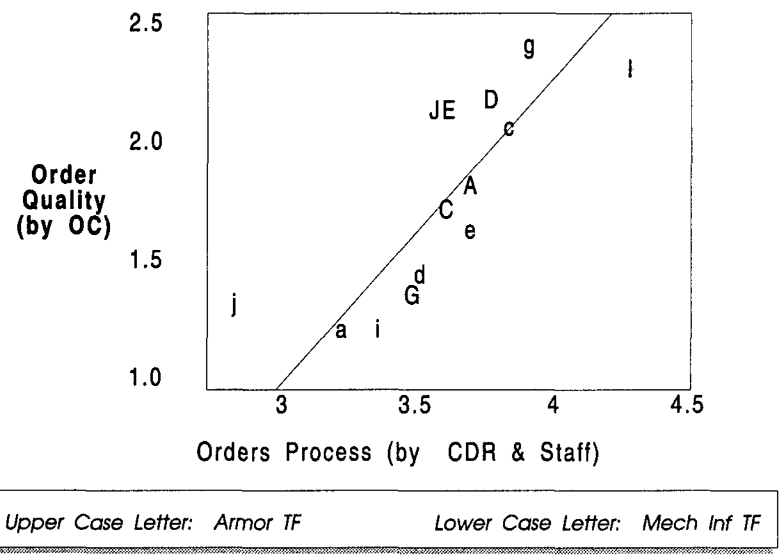
Order Quality Is Related to the Decision-Making Process

The O/Cs' ratings of the doctrinal soundness and timeliness of the orders issued by the battle staff were very highly correlated with the staff's ratings of its orders process ($r=.83$; $p<.01$). Figure 4 shows this relationship graphically. In this case, the O/C ratings were on a three-point scale; staff ratings were again on a five-point scale.

Guidance developed by CALL[4] states, "The commander . . . focuses the staff by providing an initial concept of the operation and specific planning guidance. . . . When the commander finishes his guidance, he has the staff back brief him." Responses to specific items describing the decision making process support the importance of the commander's guidance. Staff responses to the item, "The commander's intent was clear and understood by all staff members" correlated .61 with the O/C rating of order quality ($p=.01$); while responses to the item, "The commander checked with each key staff member to make sure the member clearly understood his responsibility for key actions and events" correlated .70 ($p=.01$).

CALL is also developing guidance concerning war gaming:[5] "Few staffs understand how to war game and many staff officers are not involved. . . . When the entire staff war games,

Figure 4. Relationship between staff ratings of orders process and O/C ratings of orders quality.



there is a greater chance the plan is synchronized." Item correlations support this guidance as well. Staff responses to the item, "An appropriate number of courses of action were considered during the war gaming process" correlated .71 with O/C ratings of orders quality (p=.01); while responses to the item, "All of the right people were involved in the war gaming process" correlated .69 (p=.01).

TRAIN AS YOU FIGHT

FM 25-100 stresses that leaders must "demand realism in training": They "must seize every opportunity to move soldiers out of the classroom into the field. . . ." (p. 1-1) The principle "Train as You Fight" also reinforces the notion that maneuver as a combined arms team is very important.

FM 25-100 emphasizes field training because exercises that do not involve field maneuver of vehicles are unlikely to be sufficiently realistic to train units to Army standards. The feedback to higher echelons from conducting realistic exercises is also important, as the Center for Army Lessons Learned has pointed out:[6]

> *The commander must take his unit out and actually time them performing certain actions to his standard so they understand his intent and he knows exactly how long they need to reach his goal. The unit must practice moving, digging, and fighting, and the planners must know the planning factors for that specific unit. (p. 22)*

Field exercises need to be planned and resourced to accomplish the training goals. One task force commander described insufficiently realistic field training in this way: "We do the platoon (training), and we sort of . . . put together an obstacle to be breached. We get through it and feel good about ourselves—it wasn't so bad. Well, there ain't nobody shooting at us. There's no massive artillery barrage coming at you. There's no great force (in front of) us." Under these conditions the unit being trained probably would not master the tasks it must perform, and the higher echelons would not learn how much time to allow or what resources are needed to perform the job under combat conditions.

Four aspects of training realism will be examined in this section:

- Terrain limitations affect the ability to train in doctrinal formations.
- OPTEMPO is related to unit performance at NTC.
- Use of MILES equipment enhances realism.
- A dedicated OPFOR enhances realism.

Terrain Limitations Affect the Ability to Train in Doctrinal Formations

The Army publication *Training Land* (TC 25-1) says, " . . . for realistic training the brigade should undertake an extended field exercise . . . (that) incorporate(s) all critical missions in a logical sequence against an opposing force (OPFOR)." Vignette 1 illustrates that field training of large-size units is imperative to overcome bad habits induced in lower-echelon training.

TC 25-1 states, "A training environment that restricts employment of a brigade size unit does not reflect battlefield conditions and *fails to prepare subordinate units for combat.*" (Appendix B, p. 1; emphasis added) The three posts that participated in the project vary widely in maneuver area.

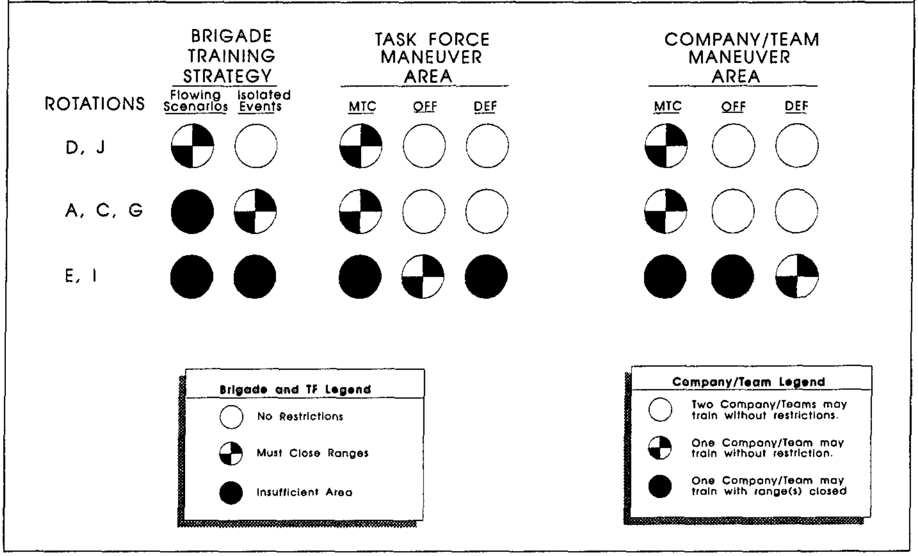
Vignette 1: The importance of field training of large-size units.

After NTC, one brigade S3 said his NTC preparation model had used too many company and platoon STX lanes, and that these had resulted in the smaller maneuver units making mistakes: ". . . you got one vehicle out there firing on you, so what's the company/platoon going to do? It's going to maneuver on that one vehicle (as they were trained to do in the STX), instead of (going) to the commander's intention (which is to bypass the vehicle) and hit the main belt." One of his task force S3s confirmed this scenario, noting also that the task force has to slow down to repair its formation when a company leaves to maneuver on a single OPFOR vehicle.

Figure 5 illustrates that the post that sent units to Rotations E and I is at a considerable disadvantage compared to the other two. Not only does this post not support brigade-level maneuvers, it does not support training company-teams in maneuvers other than defense.[7] Since FM 17-12-1 (Tank Combat Tables) recommends a company-size training area for conducting platoon-level tactical tables (p. 12-5), this post even falls short in training areas for platoons. One of the task force commanders described this training atmosphere as "sterile" resulting in his troops lacking "field discipline" and gave as examples that they habitually did boresighting in "motor pool formation" and that they would wait to be told to shoot during the live-fire exercises at NTC.

The total area and the layout of ranges are not the only characteristics of importance, although they are the basis of the ratings in Figure 5. It would be desirable that the nature of the terrain should support the type of training that units require to prepare for their wartime mission. A large post may have sizable tracts of land dedicated for ranges, but that terrain may be too wooded or swampy to support training mechanized forces in doctrinal formations or expose them to conditions similar to those which will characterize their wartime mission. For example, almost none of the posts has terrain resembling the vast open spaces of the NTC, and therefore most units arrive

Figure 5. Evaluation of training areas, by rotation.



at the NTC with little experience in managing the flow of battle across such extended ranges.

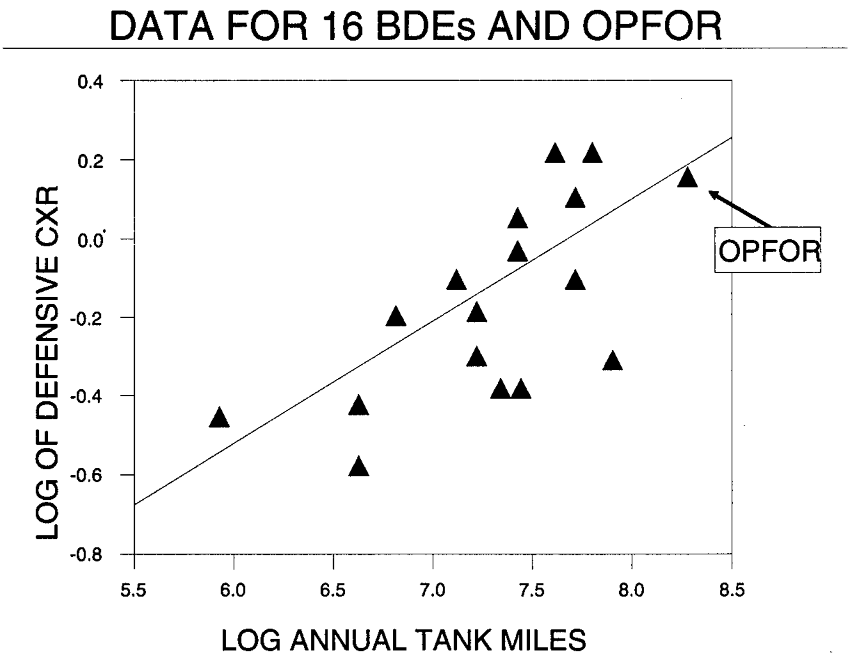
OPTEMPO Is Related to Unit Performance at NTC

OPTEMPO is commonly considered to be the mileage accrued by combat vehicles during a year of training. Mileage is an indicator of using vehicles on the ranges and training areas: Relatively higher amounts of mileage expended during the NTC preparation period indicate more opportunities to practice maneuver as combined arms teams and task forces.

As indicated in the earlier paper by Hiller, McFann, and Lehowicz, ARI conducted a study of 16 rotations (none overlap the rotations included in this study) and found that actual miles driven at the home station was related to performance at NTC. The relationship between miles driven and casualty exchange ratio was statistically significant for defensive missions, but not for offensive missions. Figure 6 illustrates the relationship for defensive missions.[8]

For the current project, records of miles driven obtained from the Army Oil Analysis Program (AOAP) were used to estimate mileage expended at home station prior to the NTC rotation. The AOAP is managed by the U.S. Army Materiel Command. The program requires that samples of oil from com-

Figure 6. Relationship of OPTEMPO to defensive Casualty Exchange Ratio (from Hiller, et al. 1990).



bat vehicles (and other equipment) be taken on a regular basis and analyzed to determine if the equipment needs specific types of service. The oil sample is accompanied by information identifying the vehicle and the odometer reading on the date the oil sample was collected. The Army Maintenance Management System uses this data to provide OPTEMPO information for Army planners and managers.

Extracts of the data base of odometer readings for major combat systems (M1, M1A1, M2, and M3 vehicles) were provided to ARI and mileage for the six-month period of NTC preparation was calculated for each vehicle. Correlations were calculated between the average pre-NTC mileage on combat vehicles in a brigade and the proportion of missions accomplished successfully by the task forces in the brigade (based on O/C ratings).

Table 3 shows statistically significant correlations between miles driven during the NTC preparation period and successful accomplishment of both live-fire defensive missions and force-

on-force offensive missions.[9] The significant correlations are consistent in direction and magnitude with the earlier finding and support the earlier conclusion that OPTEMPO is related to combat readiness.

Table 3
Correlation of Vehicle Mileage (AOAP) With NTC Performance Ratings

Type of mission performed at NTC			
Force-on-Force		**Live-Fire**	
Offense	**Defense**	**Offense**	**Defense**
.68 ($p<.05$)	.35 (n.s.)	–.43 (n.s.)	.80 ($p<.02$)

N = 7 Brigades

MILES Equipment Enhances Realism

MILES equipment is a critical element in combined arms training because it is designed to make engagements with an OPFOR more realistic than umpire judgments allow. Home-station training in the use of MILES equipment is important preparation for units rotating to NTC because at NTC all direct fire kills, hits, and near misses in force-on-force engagements are registered by MILES.[10]

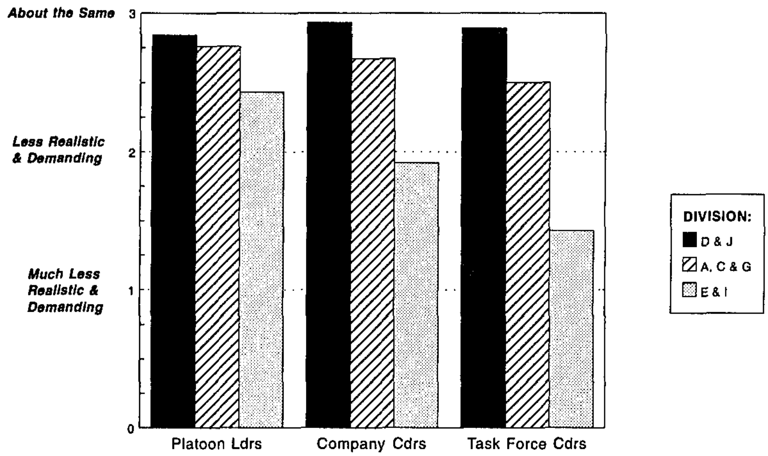
After each rotation to NTC, leaders were asked to rate the realism of MILES usage during home-station training compared to the NTC training. The scale consisted of three choices:

Code	**Response**
3	About the same
2	Less realistic and demanding
1	Much less realistic and demanding

Figure 7 shows that every echelon ordered the divisions the same way: The division sending Rotations E and I was lowest, while the divisions sending Rotations D and J were the highest. The differences among divisions are significant at $p=.05$ for each echelon.

In all cases the difference is between the division sending Rotations E and I and the two other divisions. Results indicated that this division had considerable difficulties managing MILES equipment. Rotation E involved six Armor companies,

Figure 7. Realism of home stations' use of MILES compared to NTC, by rater position and division.



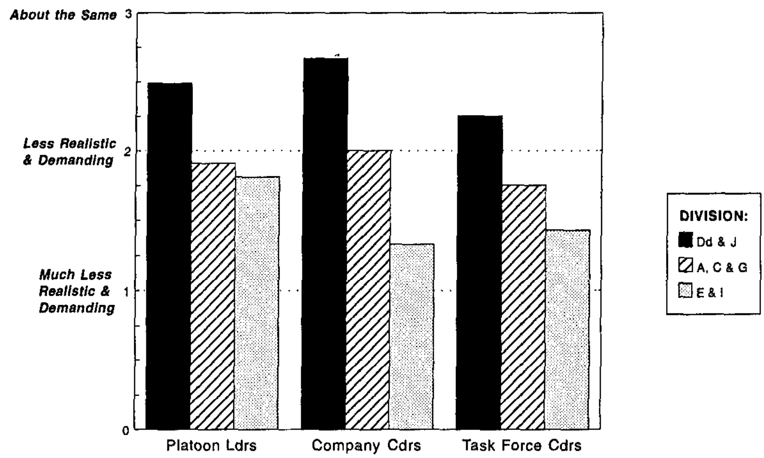
Overall Mean	2.69	2.56	2.30
Within Rotation S.D.	0.57	0.56	0.55
N	129	45	23

which overtaxed their supply of MILES equipment. The battalions had to trade the equipment back and forth during their training. Rotation E took some of the equipment to NTC in the expectation that NTC would not have enough for six companies of tanks. Long delays in turn-in and rehabilitation of the equipment meant that Rotation I was not able to obtain MILES equipment for its company ARTEPs and MILES was not fully supported during the TF ARTEP.

A Dedicated OPFOR Enhances Realism

All rotations included opposing forces for all tactical evaluations in the field. However, the quality of the OPFOR appears to have differed among the divisions. After each rotation, leaders were asked to rate the realism of their home-station OPFOR compared to that at NTC using the same three-point scale as for MILES shown above. Figure 8 shows that leaders from the division that sent Rotations D and J rated their OPFOR as more like the NTC OPFOR than did the leaders from the other rotations. The differences among divisions were statistically significant for platoon leaders (p=.01) and company commanders (p=.02), but not for task force commanders and S3s.

Figure 8. Realism of home-station OPFOR compared to NTC, by rater position and division.



	Platoon Ldrs	Company Cdrs	Task Force Cdrs
Overall Mean	2.05	2.04	1.83
Within Rotation S.D.	0.76	0.58	0.49
N	129	45	23

Information from interviews was used to identify distinctive characteristics of the OPFOR from the division sending Rotations D and J. Three related characteristics, defining a 'dedicated' OPFOR, seemed to distinguish this OPFOR from the rest:

- The OPFOR was external to the units it supported. Even the platoon evaluations were conducted with the external OPFOR. In the other divisions, platoons and companies typically opposed units from their own task force, and external OPFOR was used only for task force and higher operations.
- The home-station OPFOR was thoroughly versed in Soviet doctrine. The other divisions' OPFORs spent too little time as OPFORs to learn this doctrine.
- The home-station OPFOR modified their vehicles to resemble Soviet equipment. The other divisions did not do this with their OPFOR.

The facilities and resources that are needed for realistic field training—terrain, OPTEMPO, dedicated OPFOR, and MILES equipment—are all divisional assets and varied considerably across the divisions involved in this project. Because the

interdivisional differences in these resources paralleled the divisions' differences in performance at NTC, it is quite likely that the availability of such training resources contributed to task force combat capability. Since these resources are developed and controlled by echelons above the unit, the degree of their availability places a limit on how well a unit can train for and perform in combat exercises. Unit training approaches can of course maximize units' potential to perform within those limits, but the effects of such limits will remain, as seen in the divisional differences in NTC performance observed in this project. Only through concerted and coordinated effort within and above the unit will full combat capability be achieved. As one of the task force commanders expressed it, ". . . we need to train to the standard expected at the NTC. For that to happen, the division's got to become involved and they've got to cut the resources to allow the brigade to put the kind of stress on you that happens at the NTC."

USE PERFORMANCE-ORIENTED TRAINING

The principle, "Use Performance-Oriented Training," stresses the need to provide for realism even when units cannot be in the field. Specifically, it says that "simulators, simulations and training devices must be included in the (training) strategy." (p. 1-4) These tools are used to provide "hands on" training in the performance of tasks instead of merely talking about them.

Examination of the data from the simulation centers in these divisions did not yield accurate and reliable information about the amount of use of the simulations, the number and nature of the participants, or the tasks and conditions that were trained. Reliable data of this nature might make it possible to draw more insightful inferences about how simulations could supplement field exercises in a way that would lower overall costs while sustaining high levels of proficiency. The data available did indicate that simulations and drills enhance command and control performance.

Simulations and Drills Enhance Command and Control

To assess the benefit of simulations and drills on combat command and control, the nature and sequencing of the task forces' training events during train-up were compared to the

quality of their command and control during combat missions conducted in their later NTC rotation. The task force O/Cs rated BOS performance for each phase of each mission on a scale of 1 (Inadequate), 2 (Borderline), or 3 (Adequate). The ratings for Command and Control are shown in Table 4 for the 13 task forces with ratings.

Using this data, we selected the four most effective and the four least effective task forces based on the overall ratings. We then compared the Command and Control training each task force had conducted to see if there were systematic differences between the high and low groups.

Three findings will be discussed:

- High performing task forces conducted a variety of training events.
- Most low performing task forces had experienced a recent change of command.
- Most of the low performing task forces conducted their major Command and Control training after their task force or brigade FTX.

Table 4
O/C Ratings of Command and Control

Task Force	Planning	Preparation	Execution	Overall
A: Armor	2.67	1.67	1.67	2.00
J: Armor	2.00	1.83	2.17	2.00
D: Armor	1.67	2.00	1.83	1.83
I: Armor	2.00	1.67	1.67	1.78
A: Mech	1.33	2.00	1.67	1.67
G: Armor 2	1.50	1.83	1.67	1.67
J: Mech	1.33	1.50	1.83	1.56
D: Mech	1.50	1.33	1.33	1.39
G: Armor 1	1.33	1.33	1.50	1.39
C: Mech	1.17	1.50	1.33	1.33
E: Armor 2	1.17	1.33	1.50	1.33
I: Mech	1.00	1.33	1.17	1.17
C: Armor	1.00	1.17	1.17	1.11

Note: 1 = Inadequate; 2 = Borderline; 3 = Adequate

High performing task forces conducted a variety of events. Most task forces conducted Army Training Battle Simulation System/Battalion Battle System (ARTBASS/BBS) and conducted at least one task force or brigade CPX. All four high performing task forces went beyond the typical events:

- TF D: Armor spent additional time on orders drill that included all slice and leaders down to platoon level.
- TF A: Armor conducted a slice-specific Command Post Exercise (CPX) and a Field Maneuver Course for company commanders and platoon leaders.
- Rotation J: Armor was one of only two units that had access to SIMNET and used it most extensively. That use seems to have enhanced command and control effectiveness (especially execution).
- TF I: Armor established SOP through work among the company commanders and staff and refined that SOP with plays drills that included staff and all leader levels down to squad leader/tank commander (SL/TC).

Most low performing task forces had experienced recent change of command. Of 14 task forces in the sample, three were affected by a change of command during the six months prior to their rotation. All three were in the low group.

Most low performing task forces conducted their major Command and Control training after their task force or brigade FTX. The change of brigade commanders affected both Rotation C task forces. The timing of the change gave little time to establish the command relationships that NTC success seems to require and apparently forced the brigade to try to build the relationships in a CPX after the major field event. This created a run-walk sequence where the event to integrate the skills and procedures preceded the event to develop the skills and procedures. While the task forces in Rotation C were forced into that unfortunate sequence, TF-i (Mechanized Infantry) deliberately chose the sequence. TF-I (Armor) also did the CPX after the FTX, but they had conducted more reviews of their SOP prior to the FTX and augmented the CPXs with plays drills that probably enhanced staff operations. The experience of TF-i and the task forces in Rotation C suggest that, as a gen-

eral rule, TF Command and Control training and battle staff drills should precede the task force or brigade FTX.

All of the divisions participating in the project had M1 Unit Conduct of Fire Trainers (UCOFT) available to train tank commanders and gunners. The UCOFT keeps track of a large amount of data on the performance of each crew and provides very usable summaries of this information on demand. The next section reports on findings that support earlier research indicating that the M1 UCOFT contributes to unit performance.

M1 UCOFT Contributes to Platoon Performance

The M1 UCOFT provides training opportunities for the tank commander (TC) and gunner. The driver and loader are not trained on this device. The TC and gunner (called the 'crew' in the following description) are placed in a training environment duplicating their stations inside an M1 tank. Computer graphics are used to simulate engagements under varying conditions.[11]

The training for the TC/gunner combination consists of a series of exercises that can be thought of as a matrix, as shown in Figure 9. The horizontal axis of the matrix is the reticle aim level which is divided into six groups: Group 1 is used to introduce crews to the system and Group 6 is used to sustain crews that have completed the matrix. Groups 2 through 5 are defined by whether or not the crew's own vehicle is moving and whether or not the targets are moving. Regular progress begins at reticle aim level 8 and continues to level 39. Within each reticle aim group there are seven exercises having to do with the conditions under which the equipment must be operated. (Group 6 has only four exercises.)

The vertical dimension of the matrix has to do with system management and is related to whether there are multiple targets and how far they are from the trainees' vehicle. The front-to-back dimension is for conditions influencing target acquisition. The reticle aim level attained by the crew marks their progress through the matrix. Usually the system determines whether to advance a crew to a new exercise, but the system can be overridden to provide for repetitions of certain exercises or to accelerate advancement.

Empirical studies of the M1 UCOFT have focused on the effects of training in the UCOFT on performance in Tank Com-

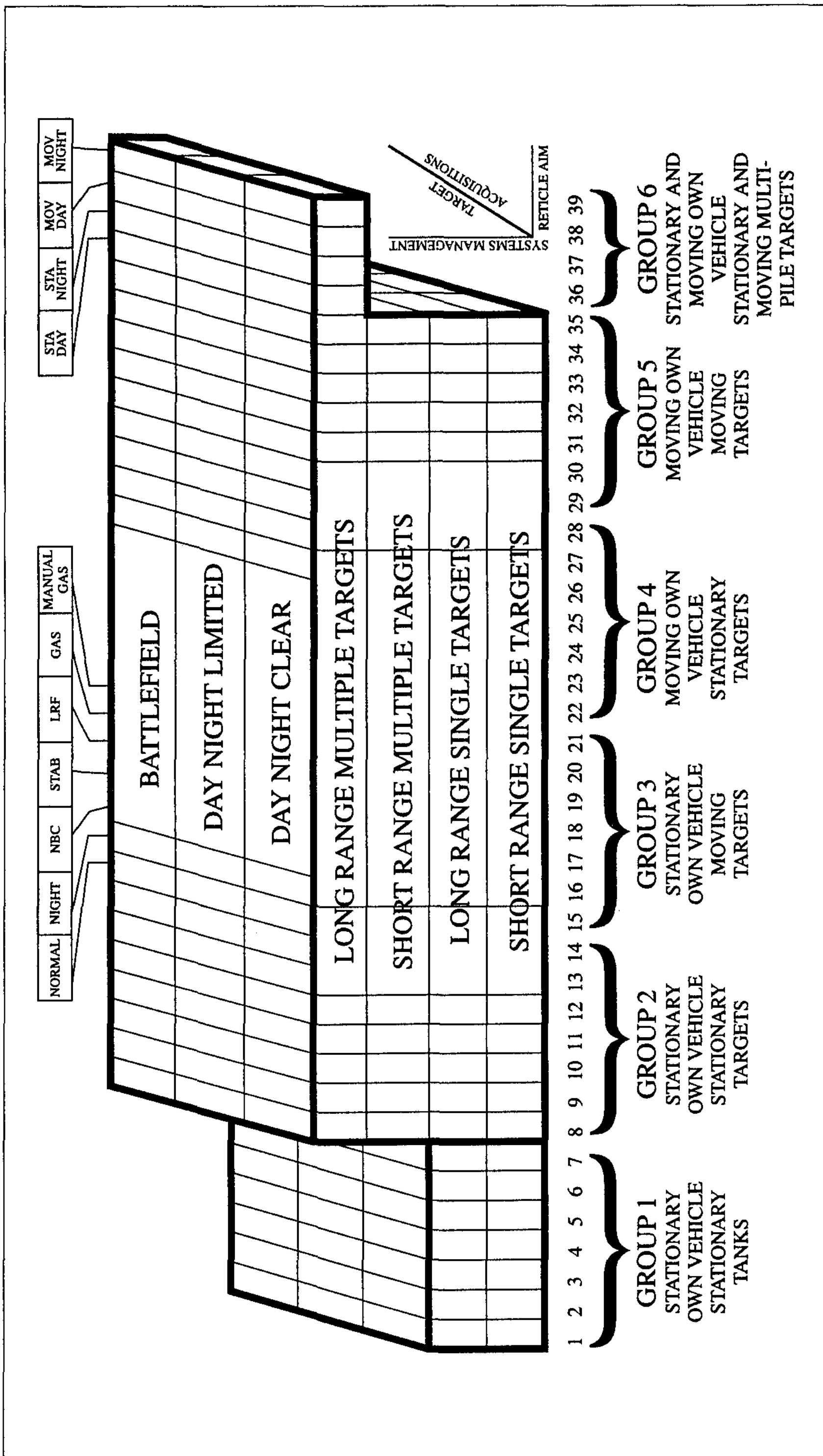


Figure 9. M1 U-COFT Commander/Gunner Training Matrix

bat Table VIII. Hughes, Butler, Sterling, and Berglund (1985) reported that there was a 22 percent improvement in opening time (defined as the time from the presentation of a target to the time the target was first fired upon) when UCOFT crews attaining reticle aim levels in Groups 3, 4, and 5 were compared to crews that had no UCOFT training.[12] The Operational Research and Analysis Establishment of the Canadian Department of National Defense used this figure in a series of computer-simulated engagements using the JANUS model and showed that an improvement of this magnitude (about 1.25 seconds) led to higher rates of killing enemy systems, provided that the friendly systems were of a capability comparable to the M1A1.[13] Less heavily armored tanks with a smaller main gun did not experience the same effects from improved opening times.

Ninety-nine armor platoons participated in the seven rotations of active component brigades that were involved in the current project. Of these, 96 platoons had one or more crews that utilized the M1 Unit Conduct of Fire Trainer (UCOFT) prior to NTC. For each of these crews project staff obtained the reticle aim level attained just prior to the NTC rotation.

At NTC, the O/Cs rated each platoon on gunnery techniques (including preparation to fire: boresighting, zeroing, etc.). The 15 Armor platoons in Rotation A were not rated on gunnery and were not included in these analyses. Although the UCOFT reticle aim score was available for each crew, the O/C ratings were obtained for entire platoons.

The reticle aim levels for all crews in a platoon were averaged to represent the platoon's level of UCOFT attainment. In the following analyses, this level of attainment (called "average reticle aim") is related to the O/C's judgments of gunnery performance during live-fire defense. Force-on-force offense missions were compromised by last-minute changes in a number of crews. Accordingly these missions are not addressed.

Two findings will be addressed:

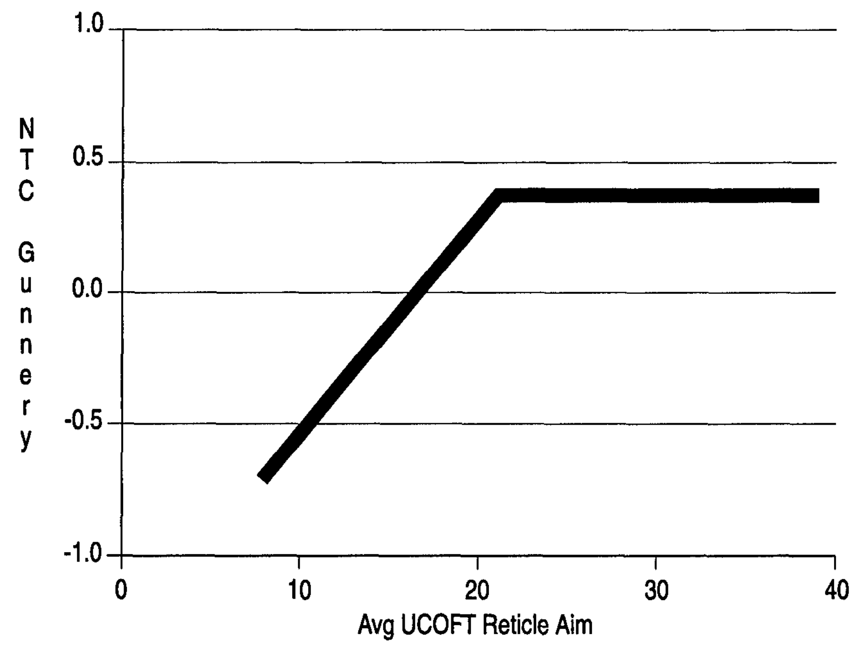
- It is important to attain relatively high UCOFT reticle aim scores.
- COHORT units are more likely to have crews attain high reticle aim scores. UCOFT benefits defensive gunnery at lower levels of reticle aim score, and the

benefit is retained as further training with UCOFT takes place. UCOFT attainment at lower levels appears to decrement performance in offensive gunnery, but attainment at higher levels is positively associated with these ratings.[14]

For defensive missions, mean reticle aim scores in reticle aim Groups 2 and 3 (scores up to 21) show a positive relationship with gunnery ratings (r=.28, p=.029). This relationship flattens out above Group 3, but platoons with mean reticle aim scores above 21 tend to have higher than average gunnery ratings. Figure 10 shows the relationship graphically.

Reticle aim scores in Groups 2 and 3 involve exercises in which the crew's vehicle is stationary. The targets are also stationary in Group 2, but move in Group 3. Group 4 and Group 5 involve exercises in which the crew's vehicle is moving. The targets are stationary in Group 4, but move in Group 5. Group 6 presents mixtures of all types of scenarios. It is plausible that

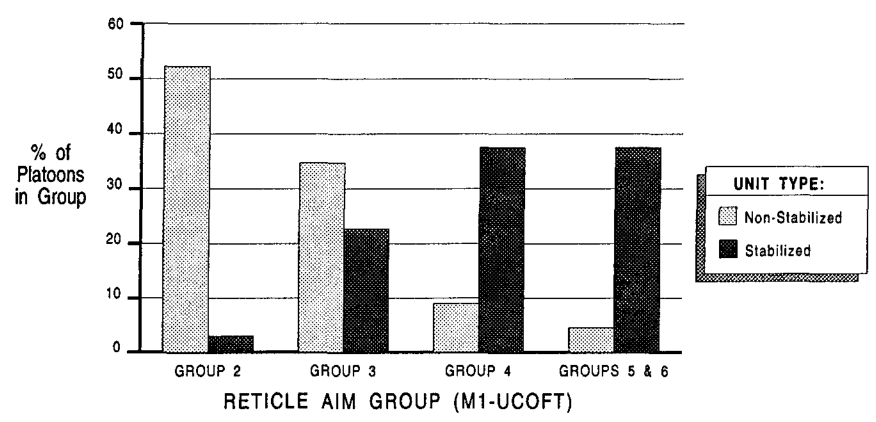
Figure 10. Relationship of M1 UCOFT reticle aim score to NTC gunnery performance for live fire Defense Missions.



progress through Groups 2 and 3 would provide the training needed to succeed on defensive missions, while one would have to gain the experience associated with attainment of Groups 5 and 6 to succeed on offensive missions. Earlier reports on the effects of UCOFT indicated that the major benefit was in reducing 'opening time,' not accuracy of fire. Finishing Group 3 would give the most benefit for opening time in defensive missions, while attaining high levels of Group 5 (or better) may be needed to reduce opening times in offensive missions.

Cohesion Operational Readiness and Training (COHORT) units are more likely to have high reticle aim scores. Attaining high reticle aim levels requires that a TC/gunner pair remain together for a long enough time to make progress through the matrix as a crew. Units find it difficult to stabilize personnel to the degree required to enable this to happen. One approach to stabilizing personnel in the Army is the COHORT system for manning. This system keeps large blocks of service members together from basic training throughout the period of their first enlistment. In the present project there were 61 nonstabilized (non-COHORT) platoons and 35 stabilized (COHORT) platoons with reticle aim information. Figure 11 illustrates the striking differences in their levels of attainment. Nearly 75% of the stabilized platoons had aver-

Figure 11. Reticle aim attainment of COHORT (stabilized) and non-COHORT (nonstabilized) units.



age scores in Reticle Aim Groups 4 to 6, while only 15% of the nonstabilized platoons attained these levels.

TRAIN TO SUSTAIN PROFICIENCY

Once individuals and units have attained appropriate degrees of proficiency, they must be provided with opportunities to practice skills and tasks to sustain that level of performance. FM 25-100 says the purpose of sustainment training is to "prevent skill decay and to train new people." To accomplish this, ". . . leaders must structure collective and individual training plans to repeat critical task training at the minimum frequency necessary for sustainment." (p. 1-4) Three findings are presented in this section:

- Sustainment training requires resources.
- Training must be paced appropriately.
- Sustainment training requires a flexible approach.

Sustainment Training Requires Resources

The capacity of a unit to sustain proficiency depends upon the turnover and turbulence of personnel, their levels of proficiency, and the resources available to the unit. In the previous paper it was shown that many units anticipate turnover after NTC to be combined with a different training focus (post support rather than sustainment training), and lower levels of resources. The training observed in the units that participated in this project seemed largely directed at bringing performance up from a low point (caused by turnover and relative lack of activity following previous rotations to NTC) to a point where the unit could benefit from the training at the NTC. This is in line with guidance in FM 25-100 to ". . . develop METL-based training programs that thoroughly prepare individuals and units for CTC rotations and similar events." (p. 3-10) During the course of the project one brigade participated in two brigade-sized rotations. The preparation for the second rotation illustrates how the lack of training resources affects sustainment of skills.

Rotation A was the second most successful in terms of force-on-force missions at NTC. On return to home station, personnel in that unit knew that preparations for their next rotation would be seriously underfunded. The brigade commander said that "For the next three months (after NTC), and maybe

through the summer, there will be no dollars for maneuver-type training these units." The division G3 said that the brigade would not be able to shoot (live fire) during the train-up of the division's other brigade (for Rotation C). He said that resource constraints might impact training for Rotation G 'to the end of the FY' and that they might have to try to shift charges for this FY into the next by accruing them late in the year.

The brigade took a different configuration of units in Rotation G from the one it had taken in Rotation A. In addition, there was some turnover and turbulence in the one task force that participated in both rotations.[15] Nevertheless, these two rotations were separated by a relatively short time (compared to other rotations from the same brigade) and represented the clearest opportunity for sustainment training during the course of the project.

Data from the AOAP program (see earlier discussion of OPTEMPO for a discussion of this data source) indicate that in preparation for Rotation A the brigade used approximately 385 miles per M1 during the six months prior to NTC, while in preparation for Rotation G it used 270 miles (see Figure 12). The discrepancy for M2 vehicles was even more striking: 242 miles in preparation for Rotation A and 75 miles in preparation for Rotation G. Ammunition expenditures (for the entire brigade) show equally striking differences, as shown in Figure 13. In this figure, the bars are ordered from left to right within each rotation to correspond to the legend. The brigade did not fire Dragon, light antitank weapon (LAW), or tube-launched, optically tracked, wire-guided (TOW) rounds during its preparation for NTC Rotation G. Survey data on the availability of blank and live ammunition showed that Rotation G was rated below the overall mean by all echelons. The variation among the rotations was not statistically significant, however.

A more pointed comparison may be made by noting that the task force that participated in both rotations was rated as performing two force-on-force missions successfully during Rotation A. During Rotation G, it was not rated as performing any force-on-force missions successfully. However, it succeeded in two live-fire missions during Rotation G, while it had only succeeded in one during Rotation A. The battalion commander, who led the task force in both rotations, had made live-fire a focus of training during the interval. Apparently he was able to

improve performance in this area, but the delay of field training, the lack of resources, and the crowded training schedule

Figure 12. Vehicle miles driven during train-up by Rotations A and G.

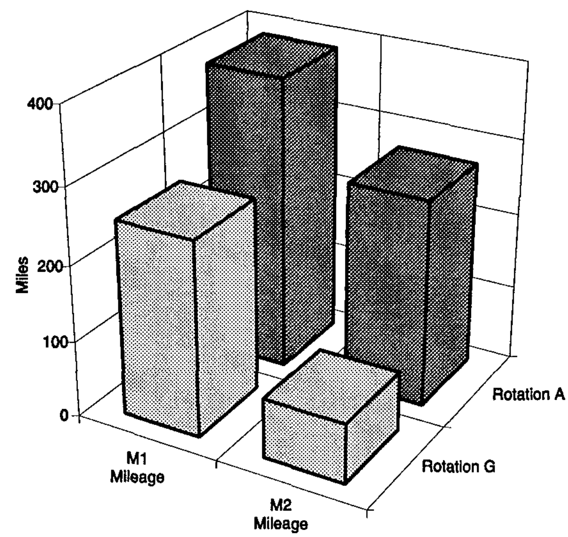
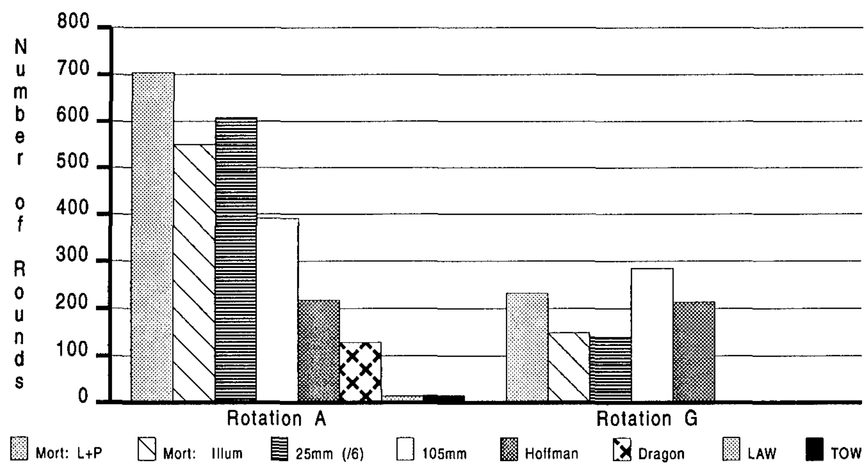


Figure 13. Ammunition expenditures for two successive rotations from a brigade.



resulted in a missed opportunity to sustain and improve performance in force-on-force missions.

Pace Training Appropriately

Examining the NTC preparation models revealed wide variation in the amount of time between major field exercises. Rotations G and I tended to compress the company and task force training into a short time frame. Rotations C and J also did this to a degree. This schedule may prevent skill decay due to forgetting and personnel turnover, but it may not allow time to reflect on lessons learned or sufficient preparation to make best use of the next training event. Rotation E spread out company and task force training events more than the others. This schedule might lead to skill decay due to forgetting and personnel turnover. Rotation E did not appear to make use of lower-cost (nonfield) training during the gap between field events. Rotations A and D spread training events more evenly through the six months of preparation.

The different effects of these approaches are not consistently reflected in the leaders' responses to questions about the opportunity to correct weaknesses or whether the training program allowed for practice on basics before training on advanced skills. Prior to NTC, leaders in each rotation were asked whether their units were given a chance to correct weaknesses noticed during training.

The leaders were grouped into three echelons: Platoon leaders, company commanders, and battalion commanders and S3s. Findings revealed that there was an overall trend for leaders at higher echelons to report having fewer opportunities to correct weaknesses. This is reasonable because the lower echelon leaders can use participation in exercises at higher echelon levels to correct weaknesses; leaders at the highest echelon have fewer opportunities to correct weaknesses they perceive in the capabilities of their units.

There were statistically significant differences among rotations as rated by platoon leaders ($p<.03$) and by task force commanders and S3s ($p<.02$). The differences reported by company commanders were not statistically significant. However, they did tend to agree with leaders at the other echelons as to which rotations were above average and which were below average.

As to the specific pacing strategies, Rotations I and J were perceived to be below the mean by each echelon, while Rotation D was perceived to be above the mean. This would seem to argue against compressing the training schedule. However, Rotation G was also rated above the mean at each echelon, while Rotation A was rated below the mean. This contrast is important because it involves the same brigade. Leaders in Rotation A might have given very low ratings because they felt that their plans were severely disrupted at the last minute by a new division commander. When this brigade returned to NTC as Rotation G, they may have adapted to the pace set by the division commander, who wanted to compress the training into a shorter amount of time (Rotation C was also influenced by this commander's emphasis on shorter training programs).

Sustainment training requires a flexible approach

Commanders must monitor the proficiency of their units closely so that they can provide opportunities for remedial training to units that have not yet mastered important tasks, yet they also need to provide opportunities for units that have mastered these tasks to perform more complex tasks. Commanders must have accurate assessments of the training status of their units in order to develop this flexible approach. And they must have opportunities to tailor missions and tasks within major field events. Information presented in the previous chapter revealed that most units did not have the battle focus to perform the assessments, nor did they have the flexibility to tailor training events to specific units.

TRAIN TO MAINTAIN

FM 25-100 states, "Maintenance training designed to keep equipment in the fight is of equal importance to soldiers being expert in its use." (p. 1-4) Maintenance training assures that equipment is ready for use in training or in combat. There are two findings to be discussed in this section:

- Maintenance training at home station is essential to success at NTC.
- Units that treated the "dust bowl" at the NTC as part of their rotation were more successful.

Maintenance Training at Home Station Is Essential to Success at NTC

The importance of the home-station maintenance training was well expressed by a task force commander: ". . . if I concentrate my efforts . . . in garrison . . . on doing maintenance by the book, the way it's supposed to be done, then it gets done that way at NTC. And that's not . . . just the individual skill, it's also a collective requirement. . . ." The importance of good maintenance to success was addressed by another task force commander: ". . . I think that the success rates of battalions out there maintenance-wise directly affects how well you do in maneuver and live-fire. If you've got 10 or 11 tanks down during live-fire you are not going to win."

Observer controllers at NTC rated the platoons on maintenance during each mission at NTC. Overall, platoon-level maintenance was considered to be a relative strength: the O/Cs gave it the third highest rating among all tasks rated (with an average rating of 2.28).[16] Rotations D and J averaged 2.43 and 2.37, respectively, on O/C ratings of maintenance. Rotation E was also above the overall mean. The others were lower, with Rotations C and I averaging 2.18 and 2.17, respectively. The O/C ratings confirm that Rotations D and J had more effective maintenance training programs.

Units That Treated the "Dust Bowl" at the NTC as Part of Their Rotation Were More Successful

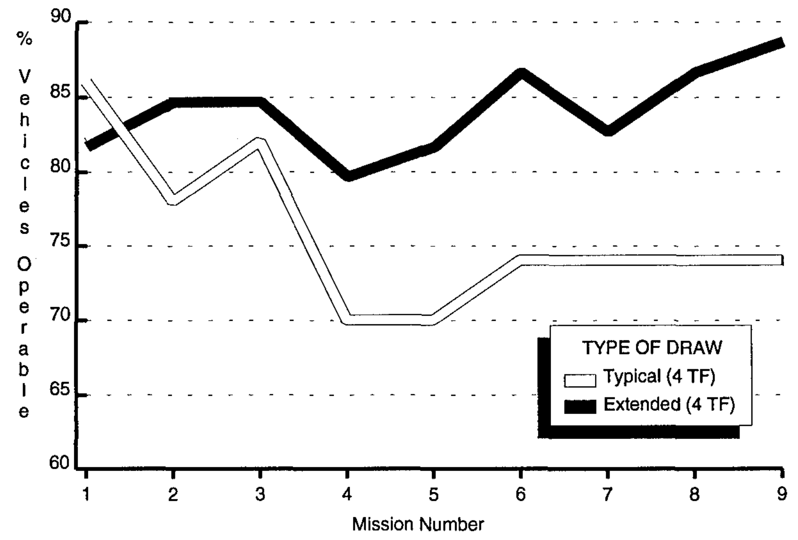
The importance of the equipment draw from the NTC "dust bowl" was emphasized by one S3: "I think . . . you need to realize that you have to get there and draw your equipment. And it's the go-to-war preparations which set the tone for what follows. So if your draw goes well . . . (you) start off on the right foot. . . ." Two of the rotations examined in this project (D and J) treated the equipment draw as an integral part of the rotation. They did three things that greatly improved the operational readiness (OR) rates of their vehicles:

- They extended time for drawing equipment (over a weekend) and paid for additional personnel hours to service the equipment.
- They declined to accept defective vehicles.
- They verified that weapons employing BLUFOR MILES could kill.

Figure 14 shows that the four task forces in these two rotations characterized by an "extended draw" had higher operational readiness (OR) rates, especially during the latter missions of the rotation. By the time of the ninth mission (in all cases this was a brigade-level offense), the task forces benefiting from the extended draw had nearly 14% more operational combat vehicles. For an entire brigade, this would amount to nearly one company-sized unit. *All four of these task forces were successful on the last force-on-force mission, compared to only two of the other ten task forces.*

The other task forces (not shown in Figure 13) brought some of their own vehicles to NTC. They generally had operational readiness rates in between those shown in the figure. However, this is very expensive to do. Commanders of one of the rotations that did this indicated that they would never do it again because it caused so much expensive wear and tear on their own vehicles.

Figure 14. Vehicle operational readiness rates by mission sequence.



SUMMARY OF FINDINGS REGARDING THE PRINCIPLES OF TRAINING

We evaluated the application of each of the five Principles discussed previously in each rotation. These evaluations were performed by Subject Matter Experts (two retired Army Colonels with extensive experience leading combat units) who reviewed the evidence presented earlier as well as the results of group and individual interviews and other information gathered at the home stations. They came to a consensus judgment on the level of application to assign to each rotation. Figure 15 shows these assessments graphically, with the rotations arranged in their overall order of performance at NTC. This figure clearly indicates that higher levels of application of the Principles of Training found in current Army doctrine leads to better performance at the NTC.

Figure 15. Application of the Principles of Training.

	ROTATION						
	D	A	J	C	E	G	I
Train as a Combined Arms & Services Team	○	○	◐	◐	●	◐	●
Train As You Fight	○	◐	○	◐	◐	●	●
Use Performance-Oriented Training	◐	○	○	◐	●	◐	◐
Train To Sustain Proficiency	○	○	◐	◐	●	●	●
Train To Maintain	○	●	◐	●	◐	●	◐
# FOF Successes	5	3	2	2	1	1	0
Casualty Exchange Ratio	0.87						0.52

○ High Application ◐ Moderate Application ● Low Application

Notes

1. In this paper ARTEP (from Army Training and Evaluation Program) refers to externally evaluated exercises.

2. Olmstead, J. A., Christensen, H. E., and Lackey, L. L. (1973). *Components of organizational competence: Test of a conceptual framework* (Technical Report 73-19). Alexandria, Virginia: Human Resources Research Organization.

3. Center for Army Lessons Learned, *Year of Training, Volume 1: Heavy Forces*, 1988.

4. *Battalion and Brigade Battle Staff Newsletter: Decision Making Process*, 90-X, Volume 1, 1990.

5. *Battalion and Brigade Battle Staff Newsletter: Course of Action Development and War Gaming*, 90-X, Volume 2, 1990.

6. *Winning in the Desert II*, CALL Newsletter No. 90-8, September 1990.

7. To make the evaluations recorded in Table 5 the requirements stated in TC 25-1 were overlaid on maps of the home stations. When the maneuver box could only be placed where it overlapped one or more impact areas it was assumed that one or more ranges would have to be closed. TC 25-1 lists maneuver area requirements for combined arms task forces, but treats Armor and Mechanized Infantry companies separately. It does not list requirements for combined arms company-teams. Mechanized Infantry requirements, which are typically larger, were used in making the evaluations.

8. Hiller, J. H., McFann, H. H., and Lehowicz, L. G. (1990). *Does OPTEMPO increase unit readiness: An objective answer.* Vol II, Army Science Conference Proceedings.

9. If the mileage data are transformed by taking logarithms, as in the Hiller, *et al* study, the correlations become smaller and are no longer significant at p=.05.

10. One brigade commander, however, felt that MILES equipment was not realistic enough to provide an accurate simulation of suppressing the enemy: ". . . if you were shooting live bullets at an enemy tank, you can suppress. It's very difficult to suppress the enemy with MILES."

11. General Electric Company (1985). *Instructor's Utilization Handbook for the M1 Unit Conduct of Fire Trainer (UCOFT); Volume 1: General Information.* Daytona Beach, FL.

12. Hughes, C.R., Butler, W.G., Sterling, B.S., and Berglund, Jr., A.W. (1987). *M1 Unit-Conduct of Fire Trainer; Post Fielding Training Effectiveness Analysis,* TRAC-WSMR TEA-16-87, White Sands Missile Range, New Mexico.

13. Operational Research and Analysis Establishment, (1990). *Iron Falcon series report on comparison of conventional and simulator enhanced tank gunnery training methods and the possible effect on operational effictiveness.* OREA Project Report No. 523. Ottawa, Canada: Department of National Defense.

14. It is important to note that the interpretation that the effects are due to whether the mission is offensive or defensive ignores the fact that each type of mission was performed in different circumstances. It could be that the effects have to do with whether the mission was conducted in live-fire or force-on-force.

15. Task Force A of Rotation A returned in Rotation G as Task Force G. (See Figure 3-1 for the composition of these units.)

16. The two more highly rated tasks were *Initial Movement on Offense* and *Issue Warning Order.*

Battle Staff Training and Synchronization: The Integration of Functions Critical to Combat Operations

Thomas J. Thompson,
Robert J. Pleban, and
Patrick J. Valentine

INTRODUCTION

Background

In 1989, the U.S. Army Research Institute's Fort Benning Field Unit (ARI-Benning) was assigned to the Training Research Laboratory's established Determinants of Effective Unit Performance research program. The focus of this research was to conduct data collection and lead research activities with Light Infantry units (Light Infantry, Airborne, Air Assault, and Ranger). Numerous areas were identified for continued, detailed investigation based on the unit home-station observations and data collected during unit training at the Combat Training Centers. Among the key issues identified for further research were staff officer preparation and synchronization of combat related activities by battalion or task force command, staff, and supporting units (Thompson, Thompson, Pleban, & Valentine, 1991), and the impact of staff synchronization and integration on unit performance effectiveness.

Purpose

This paper documents identified institutional and home-station training shortcomings and describes approaches to preparing officers to assume battalion staff duties. It also describes current and emerging research solutions designed to address deficiencies in training staff synchronization and integration. Lastly, analyses of data from the CTCs were also used to improve performance assessment objectives and methodologies. Since battalions and task forces training at the CTCs are the lowest echelon units with assigned headquarters staffs,

they represent the least complex system where the effectiveness of training for staff integration and functional synchronization can be examined. The Army's war fighting doctrine focuses on the critical role filled by the ground maneuver forces—the Infantry and Armor battalions—on the modern battlefield. As stated in a U.S. Army Combined Arms and Staff Services School (CAS3) text, "Divisions are the backbone of the U.S. Army's combat capability, and the land battle is won or lost by their maneuver battalions." (CAS3, January 1989a, p. 15).

Problems

Of the areas investigated during the initial research phase, the following three overriding training problems emerged at the battalion level and were supported almost immediately by additional source information:

- The first was that battalion level staff functional technical and tactical training has been limited generally to on the job training (OJT). The results of a follow-up survey of officer advanced course students suggested that this systemic problem existed.
- The second identified problem, supported by parallel trends from National Training Center data, was that the synchronization of critical command and staff activities has not been consistently effective.
- The third was that differences between performance measurement methodologies and techniques used at home station and at the CTCs did not always produce consistent or sufficiently meaningful results. Indeed, subsequent examination of data from the CTCs suggested that additional examination of the command and control performance measurement systems used there would be beneficial to future unit home-station training efforts and to increased combat readiness.

Investigations were undertaken to understand the characteristics and extent of these problems. The results of this research have led to systematic solutions to staff training and synchronization problems and to improvements in CTC performance measurement methodologies.

RESEARCH ACTIVITIES

The general procedures used to assess the state of battalion level staff training and synchronization included literature reviews, unit observations, and performance data reviews. Consistent existing deficiencies emerged for both Light Infantry and mixed light/heavy force (Light/Mechanized/Armor) staffs. This investigation leads to recommendations and training methodologies to improve staff functional area skills and synchronization and performance measurement that will enhance Army combat readiness at battalion and task force level.

Literature and CTC performance reviews. The literature review provided the foundation for exploration of staff training and synchronization requirements. As Light Infantry unit performance results became available they were compared with unit personnel perceptions of those performances. There were limited opportunities for statistical analyses because of the small sample size (six battalions) observed in 1990 rotating to the two CTCs. Emphasis was placed on examining data from additional rotations from the Joint Readiness Training Center because the performance measurement system used there is most closely matched to standard training doctrine.

Examination of army training philosophy and practices. It was critical to learn where staff training existed. A brief survey was conducted with officer advanced course students to determine training and duty experience levels. These were compared with the stated Army officer professional development policy and guidelines (DA PAM 600-3, 1989). Programs of instruction for officer basic and advanced courses were examined for staff functional area content. Subsequent to this inquiry, course developers for personnel and administration (S1) programs from the U.S. Army Adjutant General School, and logistics management (S4) programs from the U.S. Army Quartermaster School and the Army Logistics Management College were contacted to determine the general use of such programs by officers assigned to maneuver battalions.

LITERATURE REVIEW

Historical Context

On 15 June 1775, George Washington was appointed General and Commander-in-Chief of the Continental forces. On the following day, the Continental Congress authorized the appointment of officers to a general staff, based largely on the staff structure of the British Army at that time (Hittle, 1961). Since then the structure and functions of U.S. Army staffs, at all echelons, have been subject to reorganization to increase effectiveness and efficiency. The staff, in the context of military organizations, has been defined as a body of officers without command authority appointed to assist a commanding officer (Stein, 1980), who assist a commanding officer by the collection and analysis of information, organization of supplies and services, planning of operations (Gove, 1971).

According to current training materials, a commander's staff members and subordinate commanders are there to assist him in the direction and control of his unit's operations (CAS3, 1989b). The staff should be composed of the smallest number of qualified personnel who can accomplish the assigned tasks and each member must know in detail his particular functional specialty, as well as how that specialty relates to other staff actions. Austerity and competency therefore are the basic principles for staff structuring.

Larger organizational staffs (Theater Army, Corps, etc.) appear far more complex than might be expected if the principle of austerity is considered. In reality, a wide range of requirements at higher echelons must be met and a senior commander may need a personal staff group and special staff sections to augment the coordinating staff group which is responsible for primary functional areas (FM 101-5, 1984). In small units, defined as those organizations smaller than divisions and authorized a headquarters staff, the members may be assigned a variety of special duties in addition to their primary functional area assignments (FM 101-5, 1984). While the major responsibilities associated with each staff functional area, as well as the relationships existing between them in the operational environment, are defined by doctrine, staff training and the coordinated execution of staff actions has continued to be a subject of extensive observation and study.

Staff-Related Literature

Command and control research. In a recent review of Army command and control performance measurement research and methodologies, Crumley (1989) reviewed literature related to division, brigade, and battalion echelons. He found that the preponderance of research has taken place at the battalion level and from his perspective, its relevant beginning was in 1973, prior to the establishment of strong links between command and control measurement and computer-aided simulations. He also judged that there was very little experimental literature available describing effective analyses of command and control performance. In 1991, an initial Defense Technical Information Center, Manpower and Training Resources Information System (MATRIS) search was conducted as part of the systematic effort to identify Brigade/Battalion Training and Staff Synchronization literature. Only three citations were listed. Two addressed the Brigade/Battalion Simulation (BBS) system being developed under the U.S. Army Training and Doctrine Command Analysis Command. The third described computer-assisted training research intended to embed tactical planning tasks in the Armor Officers Advanced Course which was not implemented.

Training link to army doctrine. Barber, McGrew, Stewart, and Andrews (1979) and Kaplan and Barber (1979) found difficulties in evaluating battalion level task performance with early versions of the Army Training and Evaluation Program (ARTEP). Recently, efforts have been made by proponent developers to bridge training and mission task requirements with the ARTEP Mission Training Plans (MTP). The MTP for the Infantry Battalion (ARTEP 7-20-MTP, December 1988), contains guidance for planning and executing training on critical tasks to wartime standards. It links the Army's training doctrine in the 25-series manuals, primarily *Training the Force* (FM 25-100, November 1988) and *Battle Focused Training* (FM 25-101, September 1990), with "how to fight" doctrine found in *The Infantry Battalion* (FM 7-20, April 1992). These documents represent the latest information and descriptions of mission and task performance that are used for performance measurement at the battalion level. The continuation of reported unit command and control problems from the CTCs, based on observations and trend line analyses, suggests that additional examination is warranted.

Staff integration. Olmstead, Christensen, and Lackey (1973), while testing a model of organizational competence (Bennis, 1966), defined as an organization's capacity to cope with continuous environmental changes, used data collected during battalion command and staff tactical simulation scenarios. They concluded that individual job or task competence within an organization was a primary determinant of group effectiveness within organizations. The series of battalion staffs used as subjects was composed of ten 12-man groups of Vietnam-experienced Infantry Officers operating under controlled laboratory conditions. Subsequent work used 12 existing battalion command and staff groups (seven Mechanized Infantry and five Armor) as subjects and provided comparable conclusions (Olmstead, Elder, & Forsyth, 1978).

Olmstead et al. (1973, 1978) constructed an organizational effectiveness model grounded in the General Systems Theory model. An extensive body of work was examined, but two authors stand out for their primary contributions to the model. The organizational theories work of Bennis (1966) suggests that an organization's competence, or health, can be measured by its ability to adapt to change, identify who and what it is, and by its ability to accurately test the reality of its environment. Olmstead et al. (1973, 1978) also drew primarily from the work of Schein (1965), who identifies a series of sequential processes labeled the Adaptive Coping Cycle. Olmstead et al. used these components in their research. An important determination from the field research conducted was that when battle staff process performances were better, combat outcomes were better (Olmstead et al., 1978). Subsequent reported research has commonly been related to specific simulations, or it was undertaken to assist the development of computer-based models and have been constrained by specific simulation parameters.

Even with the advantages of computer-based aids to training, such as the Army Training Battle Simulation System (ARTBASS) and BBS, which incorporates a sophisticated tactical simulation as the operational vehicle for command and staff exercises, competency cannot easily be achieved. In *Battle Staff Integration,* Olmstead (1992) used past validation of the organizational competence model with its two elements to support further development: (1) proficiency of all individuals in process performance, and (2) teamwork among all levels so that performance of organizational processes by individuals is fully

coordinated. The model identifies necessary **organizational conditions and developmental activities in order to achieve integration**. Practical experimentation with the model in military organizations may be subject to reasonable debate, but attention must be turned to one of the fundamental components of the model, Cognitive Role Training. Cognitive Role Training, according to Olmstead, involves straightforward instruction designed to inform participants about the requirements and duties of all battle staff roles. Most importantly, it provides intensive instruction about organizational competence, the organizational processes, and their performance requirements. Part of this is role performance, in which an individual can perform through training designed to provide knowledge of (1) staff organization and functions, (2) organizational competence, (3) organizational process, (4) the relationships between organizational competence and the processes most likely performed (and how) by staff position, and (5) staff teamwork and command expectations. In essence, the individual should be trained to perform assigned staff duties and know how those duties are integrated into the rest of the command and staff activities.

In a thesis proposing a five dimensional model for high performance staff development and maintenance, Speer (1984) called strongly for quality individual training in staff functional areas. While each of the five dimensions of his model (leadership, training, communication, teamwork, and learning) are important, an effective staff must begin development with individual skill competency and this requires training. The results of fiscal year 1990 interviews conducted with commanders and staff Officers revealed that a disproportionate number of the staff officers thought they were less than fully prepared to fill staff positions. It was noted that on more than one occasion during return visits to units, a new officer filled a primary staff position (generally the S1, Adjutant). On one occasion the new adjutant was a First Lieutenant. An awareness of the Army's stated professional development policies for officers in the first phases of their careers was considered necessary to the understanding of when and where officers received training to fill troop unit duty positions.

In *Battle Command Staff Training,* Brown (1992) offers a detailed conceptual approach, based on Olmstead's models, applying constructive and virtual simulation technologies to train

battle staffs. A recent paper by Brown entitled *A New Training Paradigm* is reproduced in Section IV of this volume. Battle Command Staff Training (BCST), as advocated by Brown, is a way to combine individual and small staff team activities (Staff Task Proficiency) with competency (Battle Staff Effectiveness) building exercises to support full staff integration.

Brown advocates the development and use of what he terms "staff tables," or fixed condition exercises in a synthetic environment. Command and staff activities and processes would be trained and integrated through three levels of exercises, or tables. Basic coordination exercises would be tactical vignettes oriented to either vertical within a battlefield operating system or to horizontal staff actions required to accomplish the unit's mission. Staff action exercises would present greater challenges to the staff with more aggressive, free-flowing play. Missions would involve multiple collateral operations, such as requiring a battalion to conduct a hasty defense against a multiple brigade-sized force with priority fire support. The synchronization of activities and events and the integration of available combat power would test a staff's capabilities. Brown's illustration of a potential Command/Staff Reaction Exercise for a battalion is a delay against a larger force, but with limited Battlefield Operating System capabilities and resources. All tables would allow the command and staff (or smaller teams within the staff) to become immersed in the scenario and they could be stressed by compressing the time available to plan and prepare for the execution of the mission.

In his recent writings, Brown goes beyond the theoretical work of Olmstead and others and provides a "vision" addressing how constructive and virtual simulations can be used to train command and staff functions, processes, and integration.

Battalion staff skill training. There has been a recent proliferation of articles in popular military professional journals focusing on such command and staff topics as: Tactical Operations Center activities (Harback, 1990), battalion S1 training (Mason, 1990), intelligence planning (Galvagno & Rock, 1990), as well as more global command and control considerations (Bolger, 1990; Burkett, 1990). It is reasonable to view the publication of these articles as a method to get needed information to the field. While the articles published in *Military Review* usually address issues at echelons above battalion and brigade, a

review of the publication's annual indexes from 1985 forward showed that relevant command and control topics were published every year.

The U.S. Army Command and General Staff College trains officers to serve on division or higher level staffs, initially through the CAS3 program. There is, however, no systematic battalion and brigade level staff functional area training available for the maneuver branch officer. Battalion and brigade staff functional area training blocks were deleted from the Programs of Instruction (POI) of the officer advanced courses in 1974 (H.W. Crawford, personal communication, 13 February 1991). Specialized courses were available after advance course completion for officers enroute to staff duty assignments. Those assigned to S1 positions were to attend training at the Adjutant General School, Fort Benjamin Harrison, Indiana, and for those expecting to fill S4 positions, training would take place at the Quartermaster School, Fort Lee, Virginia. Information gathered during fiscal year 1990 determinants research led to further inquiries regarding the actual utility of this training strategy and will be presented later.

A comment in a White Paper prepared by experienced National Training Center Observer/Controllers addressed what is apparently a fairly common concern and perception of many observers (Fish, Stephenson, & Sisco, 1989):

> *The ideal staff in the ideal army should be able to take a commander's concept, interpret it, conduct planning and integrate the seven operating systems into a cohesive plan. But, how well prepared are the members of the task force staffs to synchronize the critical elements of combat power? Have they the schooling or background to play their proper role?*

Officer professional development and utilization. The Department of the Army Pamphlet 600-3 (DA Pam 600-3, 29 August 1989) describes the first phase of professional development as the time officers learn their overall branch functions and missions and their branch basic course programs. They also receive technical instruction to build branch related skills. Each officer's first assignment is supposed to provide the opportunity to apply the basic course training and to develop leadership skills in a troop unit where the Lieutenant serves primarily as a platoon leader.

As Captains in the second of five professional development phases, most officers remain assigned within their branch and some receive special functional area assignments. Assignments might include Reserve Officer Training Corps duty, liaison, or foreign area training, but not S1/S4 training. Most captains attend their own branch officer advanced course where general instruction includes branch specific modules, staff operations, administration and logistics, counterinsurgency, tactics, and force integration (DA Pam 600-3, 29 August 1989). The general description of the advanced course program further states that each officer should continue a personal education program that will enhance professional career development. In some cases this might mean specific (staff) functional area training, but the emphasis during the first seven to eight years of service is on branch proficiency.

Staff synchronization. Olmstead indicated that evidence has been mounting to support the concept that maximum effectiveness can be achieved only when a battle staff directly addresses the quality of its organizational functioning and develops capabilities that enable it to maintain functional integrity under the stress of battlefield pressures (Olmstead, 1992). In *Battle Staff Integration,* Olmstead states, ". . . it is clear that the competence of an organization to cope with its environments depends upon effective performance of each organizational process both separately and in combination."

A general review of Army doctrinal literature has not provided broad support or numerous references for battle staff integration. Crawford and Hensler (1990) and others use the term integration in conjunction with staff activities, but not necessary in the same context as does Olmstead. However, there is very consistent doctrinal support for command and staff synchronization. The capstone war fighting manual, *Operations,* FM 100-5 (January 1993), presents synchronization (along with initiative, agility, depth, and versatility) as one of the five basic tenets of Army Operations. It is described as follows:

> *Synchronization is the focus of resources and activities in time and space to mass at the decisive point. Synchronization does not mean all activities happen at the same time. It means that the desired effect is achieved by arranging activities in time and space to*

gain that effect. Synchronization is both a process and a result.

According to *Operations* (FM 100-5, January 1993), synchronization may and usually does require explicit coordination among the various units and activities participating in any operation. In battle, when communications fail and face-to-face coordination is not possible, related implicit coordination may make the difference between victory and defeat.

The chain of operational doctrine, from Army level (FM 100-5, January 1993) to company team (FM 71-1, November 1988), has consistently emphasized synchronization as a tenet of Army Operations (described as Airland Battle Doctrine in FM 100-5, 1986). *Corps Operations* (FM 100-15, September 1989) structures activities into seven groups, or Battlefield Operating Systems, which must be synchronized. The division commander must coordinate operating systems and synchronize their activities in time, space, and (operational) purpose as stated in *DivisionOperations* (FM 71-100, November 1988). The requirement for staff synchronization is stated clearly in FM 71-3, *Armored and Mechanized Brigade Operations* (May 1988), where command, or vertical synchronization, and horizontal synchronization among staff sections are distinctly identified. Task force functions are grouped into seven Battlefield Operating Systems and need coordinated efforts by the commander and staff to integrate these systems into a combined arms force tailored to meet situational requirements. In *Tank and Mechanized Infantry Company Team* (FM 71-1, November 1988), synchronization of actions in time and space to produce maximum relative combat power at the decisive point requires teamwork. The series of manuals addressed reflects the emphasis on synchronization of ground maneuver units. Parallel references to the importance of synchronization may be found in combat support and combat service support doctrine as well (FM 5-100, November 1988; FM 6-20, May 1988; FM 63-2, November 1983; FM 100-103, October 1987).

Crain (1989) provided a rationale for an applied synchronization process for command decisions through the examination of the relationships of Airland Battle doctrine, established planning processes, commanders critical information requirements, and staff responsibilities. Crain's Planning Flow Diagram, the Battle Staff Guide, presented information in a manner that

could portray parallel processes and time constrained decision points to aid activity synchronization. A separate thesis, *Synchronization of Combat Power at the Task Force Level: Defining a Planning Methodology,* was completed at approximately the same time and now serves as a course reference text for the Tactical Commanders' Development Course (TCDC) (Long, 1989). The TCDC trains brigade and battalion command designees to teach synchronization to their subordinate commanders and staffs.

COMBAT TRAINING CENTER PERFORMANCE

Light Infantry Performance Determinants Results

Light Infantry determinants research, fiscal year 1990. Battalion-sized units selected for training at either the National Training Center or the Joint Readiness Training Center (JRTC) were visited approximately three to four months prior to the rotation. Questionnaires were administered, archival training and personnel records were obtained, and a limited number of interviews were completed to establish a data baseline. Observations of unit field training took place with selected units during the train-up periods prior to rotation. In the PRE rotation visit which occurred two weeks prior to the CTC rotation, units were revisited to determine the quantity and relative quality of preparations made for the training rotation. Outsideindications of unit CTC performance were based on Observer/Controller (O/C) ratings of staff, company, and platoon mission performance. POST rotation visits were made to the units to again complete questionnaires and conduct interviews assessing the lessons learned from the CTC experience (Dyer, Fober, Pleban, Salter, Valentine, & Thompson, 1992). More detailed performance data would be made available from the archives for subsequent analyses once processing was complete.

The battalion staff was not initially identified as one of the primary areas of concern during the first year of effective unit performance determinants research. As a result, the majority of the data collection and analyses during the year focused on line company and platoon training issues. However, interviews, observations, CTC After Action Reviews, and Take Home Packages, suggested that some staff weaknesses might exist. Some of the results and findings from the effective performance de-

terminants effort were presented by Fober in an earlier paper. Additional information from questionnaires and interviews was obtained that proved more relevant to battalion command and staff discussion.

Baseline information and both PRE and POST rotation questionnaires were completed by command and staff personnel from five of six battalions. However, in some cases staff officers and company commanders changed between observation periods. It was not uncommon for continuity from baseline data collection through PRE and POST rotation data collection points to be broken for both command and staff positions. The total number of questionnaires completed, by battalion, are shown in Table 1, representing the opinions of the officers assigned at the time. Continuity from PRE to POST is not suggested.

Table 1
Questionnaire Responses by Battalion

	Battalion						
	A	**B**	**C**	**D**	**E**	**F***	**Total**
PRE N=	20	16	19	19	19	0	93
POST N=	14	18	16	20	19	22	109

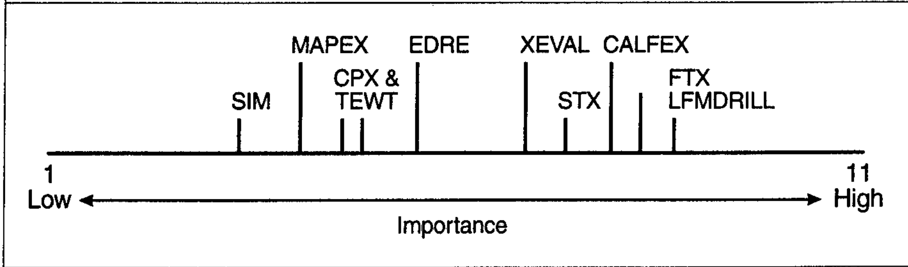
* Only POST rotation questionnaires and interviews were obtained from this battalion. Battalion staff relevant information was obtained only during the POST phase for all six units.

The results of data collection with five of the six Light Infantry battalions followed during Fiscal Year 90 revealed very limited continuity of key command and staff officers at battalion level. The Mean time a given command group consisting of commander, executive officer, and S3 served together was 4.6 months (Range: 0-10 months). Officers in each of these positions had served an average of 13.3 months (Range: 6-20 months).

Little information was obtained that specifically related to prior staff expertise and training since identifying staff training shortcomings had not emerged earlier as an issue. However, staff responses to questions which related the importance of home-station training exercises to unit combat readiness fell into two categories. Drills, field exercises, and even battalion

external evaluations (of company and lower echelon performance) were perceived to be most important, while staff and leader training events were rated as the least important. There were some inconsistencies regarding perceived training frequency requirements for leader training (Map Exercises (MAPEX): Training Exercises Without Troops (TEWT); Command Post Exercise (CPX)), but quarterly training emerged as the most common response (Dyer, et al., 1992). Staff members seldom expressed a need to attend battle simulations (e.g., ARTBASS) on a frequent basis. This was true for baseline through POST rotation responses. The illustrated relative importance of training responses is shown in Figure 1.

Figure 1. Perceived importance of training events to combat readiness: Mean ranks over all units (Scale ranges from 1 to 11). (Dyer, et al., 1992).



Though immediate O/C feedback was limited and available only from three JRTC rotations, it was clear that battalion staffs were viewed as having difficulty planning, preparing, and executing operations. Subsequent reviews of detailed AARs and THPs substantiated the initial feedback.

The responses from staff members in the post-rotation questionnaires and interviews provided more open-ended responses to command and staff questions (Dyer et al., 1992). The commanders and staff officers generally agreed with O/C comments that staff functional areas required training and coordination. In some cases, prior Command Post Exercises and other command and control activities did not exercise or stress the unit's entire command and staff system sufficiently to identify weaknesses before the CTC rotation. Generally, staff problems could be categorized as either individual staff skill weaknesses or coordination (synchronization) problems.

Individual staff functional weaknesses. The S1 in the majority of the battalions observed either had a Lieutenant serving or a Captain in transition waiting either to accept a company command or to leave the battalion. The rationale frequently offered was that the S1 NCO could handle most of the administrative responsibilities. The difficulties found in this area appear to support the need for S1 training as Mason suggests (1990). The new Battle Staff NCO Course at the Sergeants Major Academy (Cochran, 1991) may help build expertise within each of the staff sections discussed, but it does not address the reported absence of training needed by Captains filling S1 positions. There was a reported lack of recognition by units of the importance of the S1 staff section in planning, preparing, and executing operational missions.

The Infantry battalion S2s are Military Intelligence branch officers who are trained to perform as intelligence analysts. One of the shortcomings identified during interviews was that the unit's S2 would attempt to do the work of the entire staff section if the NCOs were not well trained. In some cases the S2's assessments were not given much credence because they were very junior in grade and had limited experience. Common observations from the CTCs supported the presence of performance difficulties in the S2 sections. Observers noted poor Intelligence Preparation of the Battlefield (IPB) and intelligence utilization by the operations staff. A recently published IPB-focused article substantiated the need for information and supported inclusive command and staff training to overcome IPB performance decrements (Galvagno & Rock, 1990).

While it is true that the Infantry battalion S2s are Military Intelligence branch officers who are specifically trained to perform intelligence activities, clear weaknesses in the S2 educational process have been noted (Manki, 1990). The major problem, according to Manki is that the military educational system teaches functions (or process) over substance. It assumes that the soldiers will learn the intricacies of their jobs through the unit's on-the-job training program. Manki argues that it is the school's responsibility to teach the soldiers what they need to know to prepare them for their environment. Specifically, intelligence officers must be trained and educated to develop and evaluate operational priority intelligence requirements for the maneuver battalion. However, the maneuver doc-

trine and its very existence often remain a mystery for most intelligence officers (Manki, 1990).

The logistics support for a Light Infantry battalion requires very careful planning and preparation due to limited organic transportation. Problems with load prioritization, quantities of necessary items, and a lack of formal training contributed to the problems faced by battalion S4s. The staff officers interviewed indicated that the majority of the training they had received took the form of on-the-job training. There was usually a mixture of pride in having accomplished as much as they had while they recognized that they lacked necessary skills and expertise. The majority of the S4s were aware that a logistics management course existed, and that it was usually available as an on-site course at the post level. Few were able to attend because units either did not want to spare the training time to have a critical staff officer away, or the commander was concerned that a trained officer would be transferred to a brigade or division staff rather than bring the acquired knowledge back to the battalion.

Synchronization of staff functions. The battalion staff members who completed questionnaires and were interviewed prior to their CTC rotations generally felt that they received adequate time to train as a staff and with Combat Support and Combat Service Support slice elements as well. In questionnaire and interview responses after the rotations these same staff members expressed more concern with the infrequency with which they had trained. This was particularly true with engineer, aviation, and fire support elements. While the total numbers of specific responses to questionnaire items that are presented may appear small, the range of potential response was extreme. It was typical across battalions that respondents only realized the existence of shortcomings in staff preparation after their CTC rotations. This suggests that the CTC continuous operations environment, which was not under the control of the battalion or its parent unit, was needed to reveal the true status of training within the staff.

Responses to a POST rotation question that asked what weaknesses were identified referred to specific training shortcomings, primarily at platoon and company level. However, staff officers from three of the six battalions (only POST rotation data was available from the sixth battalion) identified areas

which suggested weaknesses in staff functional synchronization, hence an inability to achieve integration. Five respondents from two different battalions thought they needed additional staff planning experience and command and staff exercises (i.e., MAPEX, CPX). Three thought additional training with their brigade slice support elements was needed. This last response was amplified in the area of logistics coordination when Class I (rations), Class III (fuel), Class V (ammunition) resupply, and medical evacuation of personnel were addressed specifically. Additional field exercises were considered necessary by 24 respondents to coordinate medical evacuation alone. Many individual responses addressed the need for combat service support coordination in one of the supply classes, but three respondents stated the specific need to exercise the battalion with complete Combat Support and Combat Service Support slice elements run by the brigade. They indicated in interviews that most command post or field exercises failed to place enough demands on the system over an extended period of time to truly train staff synchronization.

In summary, views of major strengths and weaknesses of supervision within the battalion showed eight respondents from five battalions who identified staff synchronization as a weakness. They specified S2 and S3 coordination, the IPB process (S2 activity), orders, violation of planning time rules, vehicular maintenance, and the movement of aid stations without command notification as examples. Five respondents from two battalions identified clear, simple, and timely statements of commander's intent as important. It must be noted that the majority of the positive comments came from one battalion's respondents. This battalion had the most recent combat experience and seemed to be better prepared for the CTC based on performance ratings. Respondents from two battalions identified rehearsals as critical strengths in their units. A Center for Army Lessons Learned (CALL) newsletter addressed the importance of proper rehearsals, stating, "The chance of achieving synchronization without rehearsal, especially in units which have the degree of personnel turbulence experienced in the U.S. Army, is low." (CALL 91-1, April 1991).

The responses to a request for CTC experiences that might be profitable to other units produced important comments for staff members. Staff planning and synchronization were considered critical by five respondents from three separate

battalions. Six comments representing five battalions stated that battalions must train with the slice elements and specifically with those assets they will have with them during the CTC rotation. In addition, the support elements must be familiar with the battalion's Standard Operating Procedures (SOPs), and fire support plans (both direct and indirect), execution must be coordinated with the maneuver operation, and logistics (including support CSS) must be practiced during all field training.

The battalion command and staff performance results are of limited use if they are considered alone. The CTC environment may be the only place in which staff training and synchronization deficiencies can be observed, which limits performance data requirements and opportunities. So other summaries and reviews were examined for comparison, some from single rotations, and others representing performance trends.

Related Combat Training Center Findings

Center for Army Lessons Learned (CALL). In 1986, the U.S. Army Combined Arms Command (then the Combined Arms Training Activity) began publishing a series of newsletters and bulletins summarizing lessons learned from the NTC and later, using lessons learned from all the CTCs. A regular series of informative bulletins and newsletters have focused on specific issues, one being synchronization at the company/team level (CALL, 90-6, 1990). A short story format was used by CALL to illustrate the 18 defensive and 19 offensive tasks considered by the commandants of the Infantry and Armor Centers to be critical to synchronization. Additional topical bulletins and related materials have been published to provide the Army with comprehensive summaries of Doctrinal, Training, Materiel, Organizational, and Leadership (DTMOL) lessons from operational deployments for planning and preparation (CALL, 90-9, 1990), and to provide immediate information to units participating in current operations (CALL, 90-7, 1990).

Light (and mixed) Infantry rotation observations. Among the most helpful, and relatively comprehensive CTC reviews available was a U.S. Army War College Study Project prepared by Crawford and Hensler (1990). Then LTC H. Wayne Crawford had been the most recent Senior Observer/Controller

(SO/C) at the JRTC and then LTC Robert Hensler had been a rotational battalion commander. In their study Crawford and Hensler reviewed 11 JRTC battalion THPs, the 11 related SO/C training observations, and three quarterly Observer/Controller training observation summary packets which were used to periodically report observations to the CALL, Fort Leavenworth. Wells (1989) included observations from nine prior NTC Heavy/Light force mix rotations in his summary of the first Light/Heavy rotation at the JRTC. McDaniel (1990) reported on the findings of an Infantry School team he led to observe the operations of a Light/Heavy rotation at the NTC. The Directorate of Evaluations and Standardization (DOES), U.S. Army Infantry School (Seibert, 1990), reviewed six JRTC rotations that had characteristics similar to those reviewed by Crawford and Hensler. While these and other analyses generally appear to reflect the personal observations and perspectives of the authors, and are based on limited samples, they prove to be rich in detail.

Crawford and Hensler (1990) formatted their presentation according to the seven Battlefield Operating Systems (BOSs) outlined in *FM 25-100* (1988), which are used to structure unit performance feedback at the CTCs. Staff training and synchronization comments were found not only in the Command and Control BOS, but across all BOSs. McDaniel (1990) structured his summary by DTMOL, then by BOS, with emphasis on Command and Control, and on Combat Service Support. He found systemic problems in staff operations in the Command and Control BOS. He also found that support liaison officers and teams required training to operate with maneuver branch units. Crawford and Hensler found that information flow—the synchronization of activities—during planning, preparation, and execution was deficient. Many supporting staff elements, especially the Fire Support Officer (FSO) and the Engineer, did not integrate their plans with the battalion staff maneuver plan. DOES indicated a similar finding in five of six battalions examined (Seibert, 1990). Wells (1989) described even more pronounced support synchronization difficulties when light and heavy forces were combined.

Crawford and Hensler (1990) and DOES (Seibert, 1990) found consistent staff coordination difficulties with fire support planning. This usually meant that the FSO neglected to develop target support for the ground tactical plan or scheme of maneuver, or key intelligence indicators for necessary target

suppression were missed. Crawford and Hensler found that fire support and engineering matrices were the most commonly used structures to support battle planning, preparation, and execution and half of the battalions and 60% of the companies had problems either constructing or using such matrices. McDaniel (1990) indicated that integration of fires had to be well planned, suggesting that from his observations they were not.

Crawford and Hensler (1990) found that nine of the rotations examined had an Air Defense Officer (ADO) on special staff, but of those nine, six experienced significant problems. Incomplete information and communications during staff planning contributed to the problems. In general, the ADOs were found to be weak in detailed coordination with maneuver staffs and with light force tactics. The maneuver staffs failed to fully understand the command and coordinating relationship between themselves and supporting Air Defense units. Wells found similar problems during observations of light/heavy combined arms forces (1989). McDaniel (1990) commented that common terms and graphic symbols must be learned to ensure proper planning, preparation, and execution by combined arms and services forces.

Every opportunity must be taken to integrate Combat Service Support (CSS) operations into home-station training to gain a full appreciation of its impact on tactical operations (Crawford & Hensler, 1990). This comment clearly confirms those expressed by officers responding to recent CTC experiences. The clear need for better, more detailed mission estimates by both the S1 and the S4 were identified. Many of the AARs examined revealed that more detailed casualty collection and evacuation plans (S1) and resupply plans (S4) were needed. Personnel accountability was not well executed during field operations and only three of the battalions reviewed had maintained accurate accountability. Replacement operations were also considered generally inadequate. Transportation, which is scarce in a Light Infantry battalion, requires extensive planning to obtain maximum utility from available vehicles. Few battalions were able to plan and coordinate sufficiently to meet the situational demands found at the CTCs. Such problems are not automatically solved by mixing light and heavy forces (Wells, 1989). McDaniel (1990) pointed out that CSS rep-

resented the greatest area requiring doctrinal, training (coordination and synchronization), and organizational improvements.

Fully 60 percent of the battalions and companies examined by Crawford and Hensler (1990) had significant difficulty planning for tactical operations. A quarter of the battalions reviewed did not develop a scheme of maneuver or articulate a concept of the mission operation for subordinates. A similar percentage did not manage time effectively and did not establish work priorities. Two thirds had difficulty in preparing and issuing orders. In general, battalions had stressed squad and platoon training at home station to the exclusion of multi-echelon training and the practice of the staff process. On the positive side, units that had practiced the staff process had also effectively used SOPs during deliberate and compressed planning periods (Crawford & Hensler, 1990; McDaniel, 1990; Seibert, 1990; Wells, 1989).

Table 2 provides a summary of the functional area weakness trends.

Table 2
Battalion Staff Functional Area Weakness Trends*
(X=Identified Area Weaknesses)

	Crawford & Hensler	**ARI Benning**	**Wells**	**McDaniel**	**DOES**
(Rotations)	**(11)**	**(6)**	**(1)**	**(1)**	**(6)**
S1 - Personnel Accountability/ Evacuation	X	X			
S2 - IPB Integration	X	X	X	X	X
S3 - TOC Ops, Execution	X	X	X		X
S4 - Resupply, Transportation, CSS Coordination	X	X	X	X	X
SLICE CS - FSO, Engineer, Avn, ADO	X	X	X	X	X
Synchronization of Planning & Prep	X	X	X	X	X

* This summary of observations and data analyses is not considered comprehensive but rather illustrative of the consistency in identification of staff deficiencies.

JRTC observation trends. The first quarter 1991 summary from the JRTC, which presented relevant general observation trends rather than details from each rotation, noted improvements in briefbacks and rehearsals for operations, better Fire Support Officer participation in course of action development (planning), increased awareness by S2s of scout capabilities, and improved medical evacuation plans. The trends suggesting areas that required improvement and that substantiated the reviews and analyses detailed above, were:

a. Command and Control Weaknesses—There was a lack of Fire Support planning integration (into the scheme of maneuver), a lack of combat power synchronization, and Tactical Operations Center activity management was weak. Available planning and preparation time were used poorly, and units did not integrate full (battle) staff planning opportunities.

b. Fire Support Weaknesses—Targeting processes were weak and maneuver commanders did not participate in Fire Support (planning) activities.

c. Aviation (CS) Weaknesses—The S3 Air was not familiar with air-ground operations, air planning SOPs must be developed, air liaison must aggressively seek detailed ground tactical planning information and coordinate with the maneuver staff. Aviation must learn Infantry doctrine.

d. Intelligence (S2) Weaknesses—The S2 section must constantly update and post intelligence. They must communicate with the commander early in the planning cycle and during the battle. The S2 must "make things happen" versus waiting for someone to provide intelligence. The scouts must deploy early.

e. Weaknesses in Staff Synchronization—Staff planning weaknesses limited Civil Affairs and Psychological Operations use. CSS overlays and planning need improvement and coordination with the maneuver plan.

JRTC command and control task analyses. In fiscal year 1991, data were extracted from eight JRTC rotations from the CTC archive for command and staff task performance comparisons as part of Light Infantry unit performance determinants research. The data showed the greatest degree of task continuity across rotations. While the performance measurement system in use at JRTC was designed to match the standard Infantry Mission Training Plans (DA, ARTEP 7-20-MTP, 1988), it has understandably required adjustment through exercise experience to achieve consistency. The performance measurement system in use at the time provided GO/NO GO rating for missions; Trained, Needs Practice, Untrained scheme for tasks; and GO/NO GO and NA/Did Not Observe for Subtasks. (See Fober in an earlier paper for a more detailed examination of this improved assessment system.)

An examination of the eight rotations revealed critical shortcomings in the recorded data as well as the anticipated problems with command and staff task performance. The record data structure used has been designed to accommodate all possible subtasks, so a task with fewer subtasks may have responses recorded that do not correspond to actual data points. Specifically, the review of the data could not always distinguish whether a task, or related subtask, was performed or if it was performed but not subsequently recorded by the observer. That is, it is not clear whether missing values in the data corresponded to tasks and subtasks rated or if they were attributable to absent ratings. A basic example will illustrate the point. A review of O/C responses revealed that "Did Not Observe" entries were used frequently when there were actually no corresponding subtasks available for comment. Similarly, under tasks considered trained or untrained, many supporting subtasks were left blank. These subtask performance records were often not designated as being critical to the assessment of the task performance. This raises a question that cannot currently be answered regarding the quality and relative value of these subtasks. It also calls into question the quality and value of the performance measurement system for anything other than immediate feedback to the rotational unit. Comparative examinations of the twenty rotations indicate that company and platoon level tasks were recorded more frequently than command and control ones were for the battalion or task force.

Ten tasks were extracted from the eight rotations to provide a view of command and control, primary staff functions, and related slice element performance assessments. Table 3, Command and Control Task Status, provides a summary of three key tasks. The table shows that the percentage of task observations rated as trained (T), using the TPU rating scheme, remain consistently low (21%, 15%, 21%). Each unit completed various missions during a given rotation, but not always the same ones as other units, so some differences in numbers of similar tasks completed can be expected. What Tables 3, 4, and 5 do not reveal is how many times the tasks were actually performed nor why data was missing in some cases.

Table 3
Command and Control Task Status

TASK 600:	Develop & Communicate A Plan Based on the Mission (Battalion)					
21 Cases	Status:*	T=4 21%	P=4 21%	U=11 58%	2+ 9%+	Missing Missing
TASK 602:	Prepare for Combat Operation (Battalion)					
19 Cases	Status:	T=3 15%	P=4 22%	U=12 63%	None	Missing
TASK 603:	Command and Control Operations					
19 Cases	Status:	T=4 21%	P=2 11%	U=13 68%	None None	Missing Missing

* T=Trained, P=Needs Practice, U=Untrained (% by TPU)
\+ Number and percentage of total missing cases (Not included in TPU% breakdown)

It is certainly possible that all subtasks for selected tasks were not observed, hence appropriate reporting of missing data under the category, "Did not observe," is understandable. However, the reasons for missing data within and including some tasks remain unclear. In some instances, TPU data has been recorded for subtasks that are not part of the related task, and in others no rating or explanation has been provided where one is required. It must be noted that errors in data recording could occur at any point in the processing of the T&EO data, not just during observations.

The overriding information that Tables 3, 4, and 5 present, missing data notwithstanding, is that the units were observed to either require practice or they were untrained on the clear majority of the command and control and related staff synchronization tasks.

Crumley (1989) noted that O/Cs in settings such as the JRTC typically complete their ratings at the end of missions and not as the tasks are being observed. As a consequence, the data entries or ratings may very well be influenced by the overall outcome of the mission, i.e., halo error, rather than specific unit behaviors relevant to accomplishing an assigned task. Crumley has taken the position that an individual who has been tasked to observe and control simultaneously, such as O/Cs at JRTC, cannot effectively accomplish both duties at once. Discussions by the authors with O/Cs have revealed that they will accomplish assigned tasks according to established priorities and to the extent that they are trained and provided time to do so.

Table 4 presents three selected tasks associated with battalion primary staff performance to illustrate problems identified with the primary staff's operation. The small percentage of observations rated as trained for these three tasks representing the performance of the battalions' S1, S2, and S4 sections is startling. However, they provide support for battalion level research and training development efforts since staffs are not functioning well in simulated combat environments.

Table 4
Primary Battalion Staff Performance

TASK 452:	Perform Personnel Actions					
10 Cases	Status:*	T=0 0%	P=3 50%	U=3 50%	4+ 40%+	Missing Missing
TASK 1100:	Establish Priority Intel Requirements (PIR) & Intel Requirements (IR)					
22 Cases	Status:	T=1 9%	P=6 55%	U=4 36%	11+ 50%+	Missing Missing
TASK 453:	Perform Logistical Support					
10 Cases	Status:	T=0	P=6 100%	U=0	4+ 40%+	Missing Missing

* T=Trained, P=Needs Practice, U=Untrained (% by TPU)
\+ Number and percentage of total missing cases (Not included in TPU% breakdown)

Table 5 depicts a sample of the recorded performance of the selected slice elements from the eight rotations. Once again the results are not very encouraging.

Table 5
Slice Element Performance

TASK 626:	Plan, Develop, and Communicate a Tentative and Final Task Force Fire Support Plan (Battalion)					
23 Cases	Status:*	T=0 0%	P=9 41%	U=13 59%	1+ 4%+	Missing Missing
TASK 627:	Prepare Initial Fire Support Plan in Support of Maneuver Plan					
22 Cases	Status:	T=0 0%	P=7 32%	U=15 68%	None None	Missing Missing
TASK 750:	Plan Maneuver/Countermaneuver/Security Operations					
23 Cases	Status:	T=1 4%	P=5 22%	U=17 74%	None None	Missing Missing
TASK 1025:	Develop and Communicate a Combat Service Support Plan					
31 Cases	Status:	T=6 19%	P=15 58%	U=5 23%	5+ 16%+	Missing Missing

* T=Trained, P=Needs Practice, U=Untrained (% by TPU)
\+ Number and percentage of total missing cases (Not included in TPU% breakdown)

EXISTING TRAINING PROGRAMS

Military Qualification Standards Program (MQS)

Common and branch specific tasks that are expected to be mastered by company grade officers as part of their professional development are presented in the *Military Qualification Standards II Manual of Common Tasks* (STP 21-II-MQS, 27 March 1987). According to the U.S. Army Center for Army Leadership (CAL), this manual is under revision, supplementary branch specific manuals are being prepared by proponents, and both forms are expected to be published during 1991 (CAL, 1990).

In an *Infantry* article prepared by CAL, the MQS was described as providing a framework for school commandants, unit commanders, and individual officers to use for common and branch specific officer training, education, and professional development (CAL, Nov-Dec 1990). The MQS system has been designed to provide the link between institutional training and operational assignments. STP 21-II-MQS (March 1987) does provide a limited list of administrative, logistic, and maintenance support tasks which company grade officers are expected to master. It also presents an appendix of "Officers' Special Emphasis Areas," which are typical additional duties. However, the MQS system does not provide sufficient informa-

tion to prepare officers to fill battalion staff positions. A review of the *Military Qualification Standards I Manual* (STP 145-I-MQS, September 1986), which presents the precommissioning requirements for cadets and officer candidates, revealed no reference to staff functional skills or training. Neither MQS publication provided task lists extensive enough to be considered sufficient information for battalion staff assignment preparation.

Infantry and Armor Programs of Instruction (POIs)

The objectives and course contents of current resident maneuver branch officer basic and advanced courses were examined to determine the time dedicated to training Lieutenants and Captains for battalion staff duties.

Officer basic courses. The primary objectives of both the Infantry and Armor Officer Basic Courses (OBCs) are to qualify Second Lieutenants with necessary respective branch technical and administrative skills and to train them to lead and fight their platoons. According to current POIs, OBC students receive administration, intelligence, operations, and maintenance training related primarily to their duties at platoon level, but within the context of company/team operations (AOBC POI, 30 January 1991; IOBC POI, 25 February 1991). Core Combined Arms subjects include between 35 and 44 hours of instruction in Engineer, Artillery, and Chemical operational familiarization. Maintenance and related support training varies in proportion to the quantity and complexity of equipment the Lieutenant will manage. Appropriately, no administrative, training management, or logistics and maintenance tasks have been included to prepare new Lieutenants to assume battalion staff duties because they are not supposed to be assigned to staff positions, they are to lead platoons.

Officer advanced courses. The Infantry and Armor Officer Advanced Courses (OACs) are designed to train senior First Lieutenants and Captains, usually between their fourth and sixth years of service to command companies or teams, and to serve as battalion S3s (Operations Officers) or brigade assistant S3s. The curriculums and POIs are oriented to meet these objectives (AOAC 3-91 class schedule, 15 January 1991; IOAC POI, 27 February 1991). Officers are taught to command and fight their companies or teams. They are also taught to train,

maintain, and sustain their companies or teams and to write battalion/brigade operations orders. To successfully complete the last objective, they receive instruction in the communicative arts, the Intelligence Preparation of the Battlefield, as well as Combat Support and Combat Service Support familiarization. These subjects augment core instruction, which focuses on tactical operations. Sufficient detailed instruction is not available to train battalion personnel administration (S1) or logistics and maintenance (S4) duties. The results of a survey (Thompson, 1990) of Infantry and Armor OAC classes suggest that even if such instruction were part of the POIs, many officers would have already filled these staff positions. Table 6 shows that a relatively large number of officers are trained annually in the ground maneuver branch programs. Many are expected to fill important staff positions without having received formal staff training.

Table 6
Officer Basic and Advanced Courses

	IOBC	AOBC	IOAC	AOAC
Current Course Length		16 Weeks 15.6 Weeks (FY 92)		20 Weeks 18 Weeks (FY 92)
Annual Student Load (classes)	2,156 (11)	991 (4)	895 (5)	460 (4)
Staff Training	No	No	Bn S3 Bde A-S3	Bn S3 Bde A-S3

IOAC staff preparation and experience survey results. A survey[1] of Armor and Infantry Officer Advanced Course (AOAC & IOAC) classes was used to assess company grade officer perceptions of battalion level staff training and relevant experience. The survey was conducted in fiscal year 1991 and the results were reported immediately in a memorandum to the U.S. Army Combined Arms Command's Deputy Commander for Training (Thompson, 1990). A total of 65 AOAC and 168 IOAC officers attending classes at the time responded. Table 7 presents the number and percentage of officers attending their own branch course and of those, the ones who had previously held principal battalion staff positions. Concerns were expressed by senior officers in 1992 about changes in officer

corps training and experience, post Operation Desert Storm, so the survey was replicated.

Table 7
AOAC and IOAC Staff Training and Experience

	IOAC 91	AOAC 91	IOAC 92	IOAC 93	AOAC 93
Branch Sample/ Class Total	134/168	46/65	127/155	80/117	46/63
Officers (%) Who Served As Staff Prior to OAC	75(56%)	29(63%)	75(59%)	41(51%)	26(57%)
Of Those: Who Felt Adequately Prepared For Staff	34(45%)	13(46%)	26(35%)	25(61%)	8(31%)
And: Was Any Training Received Adequate?	25(33%)	7(25%)	12(16%)	9(22%)	8(31%)

By the time officers attended the advanced course, the majority had already filled a battalion or squadron staff position (AOAC 63%, IOAC 56%). From the total sample, very few received any training to prepare them for staff duties (AOAC 15.2%, IOAC 18.7%). Of the Armor and Infantry branch officers who actually served in staff positions, less than half felt adequately prepared to assume their positions (AOAC 46.4%, IOAC 45.3%). Those officers with staff experience and some form of preparation determined that mentoring by a boss, the commander, and unit field training (FTXs) were the most effective training they had received in preparation for staff duty. However, only 25 percent of the AOAC officers and 33 percent of the IOAC officers with staff experience felt that even these two choices adequately prepared them to perform staff duties.

After briefing the results and findings from the survey interest was raised by senior officers regarding possible changes in experience subsequent to Operation Desert Storm. Advanced course officers were surveyed again in 1992 (Infantry only) and in 1993 (Armor and Infantry). Table 7 summarizes all of the samples surveyed.

The results of these surveys suggested that the majority of officers serving in staff positions at the battalion level learned

through OJT and mentoring under demanding circumstances and they are not confident in the adequacy of this preparation. This perception has been supported by the recurrent observations from the CTCs that staffs lack the necessary skills and the ability to effectively integrate activities and to synchronize battle planning, preparation, and execution.

Staff functional area training. The maneuver branch advanced courses were initially reduced in length from nine to six months in 1974. A large portion of the training curriculum removed had trained battalion staff functional area duties (H.W. Crawford, personal communication, 13 February 1991). The rationale that made removal of staff training blocks of instruction acceptable, according to institutional memory, was the plan to provide courses at the Adjutant General and Quartermaster schools for those officers expected to fill assignments in S1 and S4 staff functional areas (H.W. Crawford, personal communication, 13 February 1991; Stephens, 1990). The intent was that rather than providing many weeks of training in each staff area for all Infantry and Armor OAC officers it would be more efficient, and resource effective, to send officers who would be assigned to S1 and S4 positions to an appropriate staff course enroute to their units. It was not unrealistic for Army planners to have seen this cost-effective solution as a benefit for anticipated post-Viet Nam assignment planning and stability.

Administrative and Logistics Training

Adjutant general school. Adaptations of Adjutant General and Quartermaster Schools' courses were apparently made soon after 1974 to accommodate maneuver branch officers; however, specific courses were subsequently developed to meet user requirements (Stephens, 1990). An effective five week resident S1 course was completed in 1980, after a 1978 General Officer Committee identified systemic S1 staff problems. Routine advances were made in the resident S1 POI by the Adjutant General School and Soldier Support Center (U.S. Army Adjutant General School April 1986; April 1989) as well as in parallel correspondence courses; however, the S1 course was discontinued almost two years ago due to resource constraints. The nonresident course was linked to resident instruction, but has been discontinued as well. Personnel at the Adjutant General School have indicated that a new correspondence POI is planned (Stephens, 1990). The POIs have clearly provided the

necessary information and training to prepare officers to fill adjutant staff positions at battalion and brigade level. Some of the course work also appears to have required instructor and student interaction for optimum benefit, so Soldier Support Center training developers have been addressing the problems inherent with supporting interactive training models under TRADOC's guidance to emphasize distributed training.

Logistics training. Doctrinally based courses appropriate for S4 training remain active. Quartermaster and Ordnance school courses at Fort Lee, Virginia, and at the Aberdeen Proving Grounds, Maryland, support S4 and Maintenance Officer (FM 43-5, 1988) staff requirements. The Quartermaster OBC trains officers to fill staff positions, but they are not usually assigned to maneuver battalions, and certainly not to Light Infantry battalions. The Quartermaster School has a separate four week resident POI for battalion S4s. Maintenance and Logistics Management Courses are also available for on-site training (Mobile Training Team), sponsored by the U.S. Army Logistics Management College and the Quartermaster School (Stephens, 1990). The availability of these two to four week courses is usually through post or division sponsored programs. Infrequently, OAC graduates attend this training while in temporary duty status enroute to troop units. Interview responses obtained from commanders in fiscal year 1990 revealed a consistent hesitancy to send officers to these courses. There were fears expressed that once trained, the officer would be transferred to brigade, division, or post assignments rather than being returned to the battalion. It was also mentioned that the availability of on-post training would conflict with field exercises or would be too near the time officers were scheduled for reassignment.

Correspondence training options. Officers can elect to receive specific skill correspondence programs through the *Army Correspondence Course Program Catalog* (DA Pam 351-20, August 1989) to meet assignment needs. Observations and interviews completed during the unit performance determinants research of 1990 indicated that company grade officers are seldom afforded the time to assess their educational requirements to perform the responsibilities of staff positions. In addition, there is little evidence to suggest that relatively inexperienced officers could be expected to know what information and training they needed to perform staff duties effectively

until after they filled such a position as part of their troop unit experience.

Officer Assignment Guidelines

Recommended, or anticipated officer career assignment patterns, professional development, and associated training requirements are specified in DA Pamphlet 600-3, *Commissioned Officer Professional Development and Utilization,* dated 29 August 1989. This publication presents branch and general career patterns, outlining the appropriate relationships of training and assignments by career fields. All officers are expected to be competent in MQS I skills (DA STP 145-I-MQS, 1986) prior to the completion of the branch basic courses, during which they are commonly tested. Maneuver branch advanced courses prepare officers for company command and to fill assistant S3 duty positions, but neither the officer basic nor advanced courses provide preparation for S1 or S4 assignments. (See Figure 2.)

While DA Pamphlet 600-3 (1989) outlines an ideal description of early officer career progression, observations, interviews, and feedback from OAC officers (Thompson, 1990) show clearly that this is neither a realistic nor an accurate portrayal of actual career development. Figure 2 presents a comparison of the assignment and training guidelines described in DA Pamphlet 600-3 (1989) with the results of the 1990 OAC survey. DA 600-3 (1989) states that in the first of five officer professional development phases, the Lieutenant phase, the basic course provides instruction related to the overall mission and functions of an officer's branch along with detailed technical instruction related to branch associated skills.

Additional information was gathered during the 1990 OAC survey regarding the MQS system. Of the total number of Infantry and Armor branch officers surveyed (N=180), only 63.8 percent (115/180) were familiar with MQS II (STP 21-11-MQS, 1987), and only 45.2 percent (52/180) had used it in previous assignments. Of those Infantry and Armor branch officers exposed to training with MQS in previous unit assignments, only 62 percent (31/50) thought it helped their performance at company level, and only 48.1 percent (13/27) felt that MQS II helped their performance at battalion level. The total 1990 sample (N=229) included *all officers* attending the courses and

revealed slightly greater MQS familiarity 150/65.5%), but overall, MQS was used less (73/31.9%). The equivalent 1992 total survey sample (N=180) showed an increase in familiarity with MQS II (161/189%), as well as some increase in its use (76/42%). These samples are combined and presented in Table 8.

Figure 2. Planned and actual early career development.

Assignments	**Appearance in Career Development** 1990 Data									
Battalion S3							(X)	X	X	X
Battalion S1/S4					(X)	X	X	X		
Company Command				(X)+	(X)	X	X			
Asst S3				(X)	(X)	X	X	X		
Asst S1/S4		(X)	(X)	X						
Company XO		(X)	(X)	X						
Scouts, Mortar, Support Platoon	X	X	X							
Platoon Leader	X									
Years	I	1	2	3	4	5	6	7	8	9
Rank	2LT		1LT		CPT*	CPT		MAJ*		MAJ
Training	OBC				(OAC)	CAS3 I		CAS3		C&GSC

X = Career Assignment by DA PAM 600-3
(X) = Actual Assignment pattern

Note: * Indicates earliest opportunity for promotion
+1LTs have commonly commanded in Initial Entry Training environments

Table 8
Relationship Between MQS Familiarity and MQS Use

		MQS USED			
		Yes	No	No Response	Total
MQS Familiarity	Yes	148 (48.0%)	159 (51.0%)	4 (1%)	311 (76.0%)
	No	1 (1.0%)	92 (93.9%)	5 (5.1%)	98 (24.0%)
		149 (36.4%)	251 (61.4%)	9 (2.2%)	409 (100%)

Training Interventions

Tactical commanders' development course. The Tactical Commanders' Development Course (TCDC) was designed to train battalion and brigade commanders to synchronize Battlefield Operating Systems and to apply tactical doctrine in offensive and defensive operations and to focus on the "how to" of synchronization while planning, preparing, and executing missions. Doctrinal components and the Synchronization Matrix (Long, 1989) are used extensively during the experiential planning and preparation phases. It is frequently after having accomplished the staff planning and preparation work themselves, using the synchronization matrix, that the officers realize what their staffs are expected to do. Execution takes place using the JANUS computer-based tactical simulation. TCDC and proponent schools are expanding the use of JANUS, primarily to train battalion and company commanders. Battalion commanders are expected to train their staffs. BG John E. Miller, the Deputy Commandant of the U.S. Army Command and General Staff College at the time, stated: "Your staff won't win the war for you, but it can prevent you from winning," to emphasize the importance of staff synchronization and training in his opening remarks to a TCDC class (4 February 1991). Continued course revisions have enhanced the TCDC. Plans include offering the course and a Command and General Staff College elective and adapting the program for distributed command and staff exercises, but the development of a specific staff functional training program remains a requirement.

Battle staff NCO course. Parallel training is conducted in the new Battle Staff Noncommissioned Officer course at the U.S. Army Sergeants Major Academy. The course is designed to teach individual staff section skills and the coordination or synchronization of staff functions (Cochran, 1991). A primary course objective is to teach the successful coordination of all staff section functions during a three-day battle scenario. Formerly, a Personnel and Logistics course, designed for S1 and S4 NCOs, and a 10-week Operations and Intelligence course to train S2 and S3 NCOs existed separately. These were combined and full staff coordination was added during the play of the battle scenario. NCOs were given the opportunity to learn the functions of all sections as well as build and exercise their own skills using the Battalion Brigade Simulation system (Cochran, 1991).

The TCDC and Battle Staff NCO courses appear to help staff synchronization; however, staff officers without a foundation of functional area knowledge and experience remain as weak links to command and control performance under the stressful conditions of the CTC environment. Battalion commanders are learning to synchronize activities through participation in the TCDC, but they as well as their staff officers are products of the post 1974 OAC training strategy. The commanders probably do not know what they are asking their staffs to accomplish because they have not been trained themselves in the full range of staff duties and experiences.

DISCUSSION

Training Deficiencies

Absence of staff training. The survey results of OAC students from the Infantry and Armor Centers (Thompson, 1990) substantiated the historical perspective of "lost" battalion staff training in 1974 (Personal communication with COL H. Wayne Crawford, 13 February 1991). The S1 course at the Adjutant General School, and specific S4 logistics and maintenance programs at the Quartermaster and Ordnance Schools were intended to train not only those branch officers, but they were to fill the 1974 gap in formal training for maneuver branch officers filling specific battalion staff positions.

Mason (1990) subtitled his *Army Trainer* article addressing S1 training, ". . .the cancellation of the battalion-level S1 course signaled demise of any formal training course for the S1." He indicated that his article could help fill part of the void and he presented an action plan to train a new S1 during the first four weeks in the assignment. Mason has taken the position that appropriate formal training will not again be offered and he has provided the new S1 with "tasks" to be completed across the first four weeks of the assignment. Expected outcomes have been identified that would enable the officer to learn and perform the adjutant's duties effectively without much additional assistance. It must be noted that the outlined activities may be rigorous and time consuming, particularly in view of the typical battalion S1's schedule.

Galvagno and Rock (1990) have addressed the need for Infantry officers to understand intelligence requirements in low

intensity conflict operations. They indicated that, while a battalion S2 has information and material to support intelligence gathering operations against some insurgent forces, experience in Operation JUST CAUSE in 1989 revealed shortcomings in the system. The fact that the article appeared in *Infantry* magazine has suggested that a broader understanding is needed of the intelligence process at battalion level. Staff officers, to include the S2, apparently have not been fully prepared to provide timely and well-formatted information for the commander (Manki, 1990).

Common Failure to Recognize Deficiencies

Battalion commanders and staff officers from units observed during fiscal year 1990 did not regard leader and staff training exercises (MAPEX, TEWT, CPX, ARTBASS) as being important, nor did they think it was necessary to conduct these exercises frequently. This is an "interesting" perspective, particularly in light of numerous staff shortcomings identified by O/Cs at the CTCs. This suggests that battalion commanders and staff officers lack the perception necessary to assess their true condition because they have not had sufficient training and experience to know what they must do to operate effectively. As the OAC surveys revealed, most training received by new staff officers has come in the form of OJT experience, both in garrison and in the field. That is to say, crisis responses and quick problem solving strategies are the normal patterns rather than systematic training programs to acquire staff technical and tactical competence.

The initial observations and feedback from garrison training and field exercises (i.e., CPX, FTX) during fiscal year 1990 did not reveal command and staff concerns about staff functional area performance. Shortcomings emerged only under the rigorous simulated combat conditions found at the CTCs. At the CTCs, however, units must truly plan, prepare, and execute using all organic and slice assets as they would in a continuous combat operations environment. The requirements include staff actions and synchronization of command and staff functions under intensive and constant time and resource constrained conditions. It may be that only under such rigorous conditions, where a unit's commander and staff cannot stretch their abilities and resources to adequately compensate for deficiencies in staff knowledge, skill, and experience that problems

can be identified and subsequently assessed and measured. Observations of units under continuous operations conditions may be the only place where the command and control is sufficiently taxed to reveal flaws. However, the resulting knowledge that staff training and synchronization needs improvement has seldom been of much benefit to the specific unit. Knowledge that could be transferred to improve home-station training has commonly gotten lost. Units often have significant command and staff changes after a CTC rotation, but it is not unlikely to assume that the commander or staff officer has learned from the experience. However, the knowledge gained may be situational, unique, and incomplete, since the experience does not necessarily reflect any systemic or intentional learning.

Many of the CTC observations could raise questions of perspective or bias. Though sometimes anecdotal in nature because of the limited numbers of rotations, the evidence suggests that staff training and synchronization problems have been identified and effectively described. However, they require systemic innovations to solve them and to enhance home-station staff training and performance measurement.

The Performance Assessment System

Observer experience. A related, and possibly more difficult area for training developers to address without research assistance is the improvement of the training consistency, quality, and effectiveness of the measurement system used at the CTCs to assess command and control and staff synchronization performance. In particular, the JRTC relies primarily on O/Cs who are trained and gain experience through multiple rotation observations. We know that O/Cs are themselves products of the same limited staff training system as other officers and NCOs and therefore require rigorous preparation to perform effectively. Nowhere in current institutional training programs can a junior officer, either in a unit or as an O/C, become familiar with the responsibilities of each primary staff position as well as comprehend the relationships between them. In that the JRTC O/Cs live with the unit during the rotation, duty as an O/C may be as rigorous and fatiguing as being a member of the unit. The number of rotations each year also puts stress on the O/Cs. Limited time between rotations also limits the ability of the Operations Group to provide training.

Leadership within the units observed in fiscal year 1990 reported long hours of planning and preparation prior to mission execution. Missions were followed by AARs, which required participation by unit leaders and O/Cs. Subsequent mission orders were issued and leaders and O/Cs began the process again with little rest time. Soldiers within squads and platoons indicated that they were frequently able to rest and prepare between missions, but it was not uncommon to hear leaders say that they received little sleep during their rotation. The latter generally held true for the O/Cs as well.

The necessity for rest and sleep during continuous operations has been recognized and emphasized in popular military literature (Moloff, 1990). Current research findings (Pleban, Valentine, Penetar, Redmond, & Belenky, 1990) have shown that soldiers participating in continuous operations training who do not receive sufficient recuperative sleep become more irritable, anxious, and fatigued over time. An earlier field experiment, conducted by Pleban, Thomas, and Thompson (1985), showed that sleep loss accentuated performance decrements on certain cognitive tasks. While FM 22-9 *Soldier Performance in Continuous Operations* is under revision, the 1983 edition addresses performance decrements that result from sleep loss in its Appendix A. What has not been explored is the extent to which instructor and O/C behavior is negatively affected by such operational stresses, e.g., rating errors and biases, attention and vigilance deficits. An earlier literature analysis (Thompson, 1989) and the continuous operations field research noted above (Pleban, et al., 1985; Pleban, et al., 1990) did not, unfortunately, examine instructor performance (i.e., ratings, evaluations) as a moderator of training effectiveness.

SUMMARY

The transient nature of battalion staff assignments, the relatively short periods of continuity officers have on a battalion staff, the reduction of formal staff familiarization training opportunities (Mason, 1990), and the practical difficulties in complying with officer utilization and development policies (DA PAM 600-3, 1989) might suggest that no staff training and synchronization problems exist. However, documented observations and unit performance indications from the CTCs (Crawford, 1990; Fish, Stephenson, & Sisco, 1989; Wells,

1989), as well as the practical signals provided by the establishment of the TCDC and the Battle Staff NCO courses clearly counter that assumption.

Current systematic training. DA 600-3 (1989) states that in the first of five Officer Professional Development career phases, the Lieutenant phase, the basic course provides instruction related to the overall mission and functions of an officer's branch along with technical instruction that provides the detailed knowledge and required skills associated with the branch. Examination of the current MQS II revealed no introductory tasks that provided even basic knowledge and comprehension level (Bloom, 1956) staff training. The first stated staff training objectives (S3 only) for Infantry and Armor officers are in the Advanced Course programs. No evidence of systematic staff functional area training exists for officers in the maneuver branches during the branch-oriented phases of their professional development.

The two most common forms of training received by officers in Infantry and Armor battalions are OJT experiences and related mentoring by the commander, neither of which are perceived by officers as particularly effective (Thompson, 1990). The absence of formal or structured staff training was not recognized as a real deficiency by the battalion commander and staff until the unit trains at a CTC. The time constraints, fatigue, and lack of skill and experience stressed the primary staff members beyond their ability to compensate for lack of individual job knowledge and comprehension and their collective inability to synchronize actions in a continuous operations environment. Training at home station, no matter how rigorous, apparently cannot replicate the conditions that consistently clarify staff performance deficiencies.

Staff synchronization and integration. Training programs, such as the TCDC and the Battalion Staff NCO course have been initiated to enhance the synchronization of Battlefield Operating Systems in mission planning, preparation, and execution. While effective in attaining their purposes, they cannot compensate completely for the deficiencies in staff functional area training of the maneuver battalion's staff officers. The deficiencies in individual knowledge and comprehension detract from the staff collective ability to synchronize activities and to integrate the battle staff.

Efficacy of staff integration experimentation. Olmstead's (1992) compelling call for demonstrative experimentation to support his battle staff integration theory is probably premature because the conditions do not exist to support it. The work of Brown (1992) may well provide an effective vehicle through simulation to apply Olmstead's work. Brown advocates After Action Reviews of unit (staff) performance compared to an established example. The complexity of scenario performance analysis to date has not supported this portion of Brown's work. However, recent developments in the area of functional assessment across Battlefield Operating Systems, currently called Critical Combat Functions (CCF), may support Brown's approach. The CCF work being conducted through the Army Research Institute includes a detailed plan for combat operations (CCF 18). This analysis depicts the collective tasks necessary to plan for the conduct of operations by a heavy combined arms and services task force (Harrison, 1993). Collective tasks primarily performed by the task force command and staff are detailed across Battlefield Operating Systems and echelons. A framework to assess the appropriateness, and effectiveness of command and staff functions and processes can be established. Of a total of 39 identified CCFs, 24 are being developed in detail. They will identify interrelationships of critical functions, in combat, across Battlefield Operating Systems which give promise to supporting Brown's (1992) After Action Review development for Battle Command Staff Training.

The authors know that the Cognitive Role Training requirement in Olmstead's model (1992) cannot be met under present conditions because it assumes that officers will receive at least familiarization training with all staff areas. They do not. The model Olmstead outlines in *Battle Staff Integration* (1992) also requires organizational competence, consisting of (1) proficiency of all individuals in process performance, and (2) teamwork among all levels so that performance of organizational processes by individuals is fully coordinated. The subsequent assessment of effective staff integration through use of the Adaptive Coping Cycle (Schein, 1965) or an equivalent model relies on adequate training and experience which might well be provided by Brown's application of constructive and virtual simulation technologies to training (1992). What is not present is the initial familarization, or Cognitive Role Training task. Simulation can be used effectively to build skills, but what is

required first is knowledge and comprehension of duty and functional requirements. This is a small but critical step.

The first part of the Olmstead model is conceptually similar to task training and realistic job previews discussed by Pleban, Thompson, Valentine, Dewey, Allentoff, & Wesolowski (1988) and Premack and Wanous (1985). However, general familiarization instruction in the primary battalion staff roles for maneuver branch officers ended in 1974. Some officers, though not in any systematic manner, have been exposed to either administrative staff training, or logistics and maintenance training only.

The second critical requirement for battle staff integration is teamwork, part of which requires sufficient staff stability for members to learn each other's strengths and weaknesses. The limited continuity of key staff members (4.6 months) observed in typical Light Infantry forces during fiscal year 1990 negates this fundamental condition for the model's application. In essence, the conditions do not currently exist in the U.S. Army to test the efficacy of Olmstead's Battle Staff Integration model. The introduction of Brown's simulation applications may prove very effective at this point. They could confirm individual competence, small team synchronization, and through battle command/staff table immersion training, full staff integration.

Performance assessment. The CTC observers, whether at the JRTC, Combat Maneuver Training Center (CMTC), or NTC could acquire a great deal of information and comprehension of unit performance by using adapting standardized assessment methodology. (See Fober in an earlier section.) Whether the O/C can accurately assess the dynamics of command and control activities, particularly those that have a larger proportion of cognitive components rather than more easily observable behavioral anchors, is an issue of on-going research. Sufficient O/C training time and identification of task priorities are also issues. The stressors on O/Cs during the performance of field observation and exercise control duties may be similar to those felt by unit members. Comments from unit leaders and relevant past research (Pleban, et al., 1990; Thompson, 1989) suggest that quantifying the effects of such stressors and examining other performance measurement system components would prove beneficial to Army training and unit readiness.

Guidelines and constraints. Training development recommendations must be placed in the context of the research and development issues presented in the introduction. The underlying considerations and resource constraints that influenced the initial research consider the guidelines established by TRADOC in the Army Training 21 integrated training strategy (TRADOC, October 1989; TRADOC, November 1990; TRADOC, Final Draft, April 1991). In summary, current research directions follow the emphasized strategy that calls for a shift from residential to distributed instruction in the 1991 coordinating draft changes to TRADOC Pamphlet 350-4 from the 1987 version of the document (TRADOC, 1987; TRADOC, Final Draft, 1991).

TRAINING DEVELOPMENT RESEARCH AND RECOMMENDATIONS

Pre Staff Assignment Training

Officers must receive adequate staff functional area preparation prior to a staff assignment. This means that training must occur during the first career phase or early in the second one, while the officer is a Lieutenant or Captain (3-5 years of service). Experience as a platoon leader cannot be interrupted, but staff training must be made available prior to the assumption of staff duties. This requirement emphasizes training within the unit, but it must not represent a significant detraction from routine duty.

Immediate intervention. A prototype handbook that provides basic staff functional area duties and coordination responsibilities was developed as a result of this research. The *Commander's Battle Staff Handbook* (Pleban, Thompson, & Valentine, 1993) provides a quick-fix familiarization and initial training solution for unit commanders and their staffs. Relevant doctrine and a realistic job preview are incorporated with reference material to allow an officer to "get started" as a staff member. The battalion commander can use checklists in the handbook to guide expectations of each staff member and the checklists help staff determine what information they need from their commander and fellow staff members to accomplish mission planning, preparation, and execution.

The *Commander's Battle Staff Handbook* (1993) was developed through a review of doctrine and training literature with

extensive Subject Matter Expert reviews. Training developers, battalion commanders and staffs, and highly experienced CTC (JRTC & NTC) cadre provided significant information and reviews across a fifteen-month period. Draft copies were made available for review and feedback to both active and reserve component units. Master copies were made available for reproduction and illustrative uniform cargo pocket size copies were distributed for field use. The detailed development and response to the prototype will be reported at a later date. The U.S. Army Combined Arms Command is currently considering publication of the handbook as a training circular to provide an immediate response to staff training requirements.

Battle staff training. A systemic training program is required to correct existing recognized staff training deficiencies. TRADOC's Army Training 21 guidelines appropriately emphasize distributed training across the next decade because of decreased funding and training development resources. The downsizing of the Army and reduced resources do not make residential instruction a viable approach to solving the problem.

A prototype distributed staff training strategy is being developed which can be implemented at unit home station. The design includes individual functional area instruction using a mixed media delivery system for the most effective training. The synchronization of staff functions will be accomplished through computer-based instruction, modeling staff activities to introduce the new staff member to coordination requirements and to prepare for full staff exercises. Existing personal computers and telephone networks will be used to support an Asynchronous Computer Teleconferencing model. Proponent doctrinal material will be used to develop basic blocks of instruction and the unit's parent division staff is envisioned as the source of Mission Essential Task List (METL) or Standard Operating Procedure information.

A newly assigned staff officer should be able to complete a brief reading assignment, insert a training disk in his personal computer and, by completing a one-to-two-hour block of instruction daily during his first couple of weeks in the assignment, build sufficient skill to perform effectively. He should be able to communicate with peers in the same staff position in other units, with proponent school representatives who can

clarify doctrine and training issues, and with parent unit staff members to gain METL-based experience through computer-based exercises.

Field testing of Brown's Battle Command Staff Training concept is worthy of consideration as part of ongoing constructive and virtual simulation programs.

Program changes. Changes and additions to the Tactical Commanders' Development Course (TCDC) indicate that an effective program has been developed to teach operational synchronization to commanders (Lussier & Litavec, 1990). An article in *Soldiers* suggests similar training gains can be achieved by NCOs working in staff sections (Cochran, 1991). The TCDC is currently being considered as either an elective or core block of instruction for the Command and General Staff College curriculum. The TCDC model is being adapted to provide a distributed command and staff training program under the Battle Command Training Program as well.

An abbreviated adaptation of the TCDC model is being used by the CTCs to provide synchronization and integration familiarization for rotational unit commanders and staffs prior to their CTC experience. At the JRTC the Leadership Development Program is distributing the prototype *Commander's Battle Staff Handbook* as part of this program.

Future directions. Asynchronous Computer Conferencing, which is perhaps the most sophisticated distributed training system currently available, has been developed and modeled using the Engineer OAC (Phelps, 1987). This system may prove too costly for many routine applications today; however, continued experimental applications with the Asynchronous Computer Teleconferencing adaptation offers a format for achieving the highest cognitive levels of educational objectives (Synthesis and Evaluation) through means as simple as electronic mail communication. This is a relatively economical method for networking specific training and staff exercise programs. The use of simulations and networked distributed training can be expected to grow significantly.

Performance compliance. Establishing a "gate" for staff training programs as a firm branch advanced course prerequisite or for unit assignment certification would ensure distributed training program completion. This would be similar to completion of the CAS3 Phase I before being permitted to at-

tend the resident phase. The gate would provide maximum benefit if it preceded any staff assignment.

Research opportunities. The addition of resident advanced course instruction could be accomplished through effective tactical training simulation design, but this solution remains unlikely. Though reductions in available training development specialists in the proponent schools make both resident and distributed branch specific instruction improvements difficult, near term and longitudinal analyses could assess the effectiveness of distributed training strategies by the Infantry proponent. The range of available delivery systems, from conventional paper-based to various computer conferencing systems (Hahn, Harbour, Wells, Schurman, & Daveline, 1990; Thorn, 1990) must be assessed to determine the optimum training value for the user.

The theoretical components postulated as critical to battle staff integration (Olmstead, 1991), the understanding and developing measurement methodologies for critical information and staff communication requirements at battalion level (Crain, 1990; Kahan, Worley, & Stasz, 1989), and the enhancement of instructor performance (Thompson, 1989) cannot be examined as thoroughly anywhere else. The JRTC remains an important continuous operations training center, supporting low- through mid-intensity conflict training for light forces. It is also the only controlled environment in which a broad range of research opportunities designed to support light forces combat readiness can be accomplished.

The analyses of command and staff performance, as well as other critical combat functions can be enhanced by using recent and emerging research results (Harrison, 1993). Large scale constructive and virtual simulations afford an opportunity to test Olmstead's (1992) theoretical work using Brown's (1992) paradigm for simulation-based training.

Notes

1. Thompson, T. J., Pleban, R. J., Valentine, P. J., & Thompson, G. D., designed, administered, analyzed, and summarized the information reported by Thompson in memorandum form. CPT (P) D. J. Litavec, of the ARI Fort Leavenworth Field Unit, provided assistance with question topics based on

experience with the Combined Services Staff School curriculum.

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SECTION III

The Human Dimension in Combat

The papers presented in Sections I and II provided an objective basis for the measurement of unit performance and for identifying the determinants of effective unit performance. The following paper by Ozkaptan of ARI is included to emphasize the point that preparation for combat includes more than the technical and tactical training of soldiers. Specifically, that the morale, motivation, esprit de corps and the fear, courage, and anxiety levels of individual soldiers are critical to the conduct of warfare.

General (Ret.) Crosbie E. Saint, when he was Commander-in-Chief, U.S. Army Europe, directed the publication of a guideline for his commanders that addressed the principles addressed in this paper. Copies of that guide, Battlemind Guidelines for Battalion Commanders, are presently distributed to the attendees of the pre-command course at Vilseck, Germany.

A considerable amount of research has been conducted to measure the effects of soldier morale, motivation, and cohesion on performance outcomes in simulated combat. What the results from these efforts reveal, however, is that there tends to be little variability in such measures, so that they lack predictive power for the results of simulated combat.

Given the practical difficulties in conducting valid empirical research on soldier courage using simulation, we have included this paper to address those human considerations that can be expected to play a significant role in actual combat.

Determinants of Courage

Halim Ozkaptan

INTRODUCTION

Courage, as every military leader knows, is at the heart of a soldier's combat performance. Courage is the result of a soldier's fortitude, inner strength, and the will to persevere despite fear and the adverse conditions of combat. Teaching a man[1] to fire a rifle and to use military equipment alone does not make him a soldier. A soldier's courage is shaped by Army values and a set of training principles which help to develop his spirit and his relationship with his comrades.

Du Picq (1946) observed that the history of war is in reality the history of increasing fear and confusion, and that while technology and tactics may change, the human element remains the same. Military leaders have recognized that it is the will of the soldier that is decisive, rather than technical or numerical superiority. A battle is decided when individual soldiers stand firm or lose their resolution to stand and fight. Until that moment, combat is a mutual and sustained act of will between contending parties.

> *When the chips are down, there is no rational calculation in the world capable of causing an individual to lay down his life. On both the individual and collective levels, war is therefore primarily an affair of the heart. It is dominated by such irrational factors as resolution and courage, honor and duty and loyalty and sacrifice of self. When everything is said and done, none of these have anything to do with technology, whether primitive or sophisticated.*
>
> *van Creveld, 1989*

History is replete with examples where whole Armies have been routed without obvious injury except for their fear. "Superior forces" have often been held at abeyance or routed by smaller or less technically advanced Armies. In terms of their fighting effectiveness, the German Army during World War II ". . . enjoyed a 20 to 30 percent advantage over the western allies, and for most of the war, a 150 percent superiority over the

Russians" (Kellett, 1980, p.16). Clearly, an Army's effectiveness is more than the sum of its men and equipment. It also depends upon the degree to which the principles underlying the nature of man, and of men acting together, are understood and applied during training. These principles, and the influence of fear, are discussed below.

THE ROLE OF FEAR[2]

Fear plays a central role in the human dynamics of battle. This is to be expected, since the battlefield is a radical change of environment and experience from what a soldier or any person is normally accustomed to or has experienced before. The effects of battle are sudden, intense, and life threatening. A soldier is challenged to his very core by the awful conditions and stresses of battle. One's potential demise is no longer in the realm of imagination but a very real possibility.

A soldier is still a being whose emotional foundation has not changed over the centuries. The secretions of the endocrine system are involuntary, as are the feelings of fear. No one is immune to fear and apprehension of danger. This basic physiological fact has not been adequately recognized or addressed by the military. Moran (1966) reported that during World War I, ". . . fear and foreboding were regarded as morbid and no proper subject for discussion in the mess."

Fear must be recognized as a normal human reaction to battle. Medal winners, as recognized heroes, are more willing to admit to having been fearful.

> *Demonstrably brave soldiers (medal winners) were more likely, than less obviously brave soldiers, to report an increase in their fears as the battle progressed. A comparison of ninety Silver Star winners with ninety matched non-award winners, showed that 66% of the award winners reported an increase, and 20% a decrease in their fears. Comparable figures for men who did not win the Silver Star were 55% and 32%, respectively.*
>
> *Kellett, 1982, p. 301.*

Both the brave and weak are afraid. Depending upon the circumstances, an Army can alternately be seized by fear and bravery during the same battle. Fear can also be contagious.

Under fear, or apprehension of impending danger, a person's threshold for fearful events is lowered and his emotional dependence on others increased. His perceptions become distorted, and otherwise normal events can appear threatening.

Some degree of apprehension is not undesirable, as it can heighten a person's awareness and preparation for battle. The severe effects of fear, however, should not be underestimated. It can contribute to psychiatric casualties variously known as shell shock, combat stress reaction, and battle fatigue, which have led to serious depletions of fighting resources. Often the fear of expressing fear can lead to hysterical reactions with a temporary paralysis of body functions. While these are psychogenic reactions, their physical effects are no less real and disabling. This permits a soldier to unconsciously solve his problem without the "loss of face" or self-respect.

A soldier's duty is in essence an act of courage, which cannot be counted on in every soldier and in every situation. The successful soldier is one who is able to manage or control his fear and anxiety rather than being overcome by them. A soldier will stand and fight despite his fear in relation to the degree and amount of his fortitude.

If a soldier's fortitude is low he may flee (proper retreat to preserve assets or cowardice), or have some form of combat stress reaction. If his fortitude is high, he will overcome his fear (courage) and persevere. In effect, courage and cowardice are two opposite effects that can result from a person's reaction to fear. As courage is the manifestation of fortitude in the face of fear, cowardice may be considered the result of succumbing to fear or apprehension.

A Soldier's Fortitude

Fortitude is the "strength of mind allowing one to endure pain or adversity courageously" (Webster, 1984). It can also be described as inner or moral strength, will power, and resolution. The term "Battlemind" has been coined to serve as the military term to describe fortitude. It is a state of mind that can be developed through training.

Many military leaders, both before and after Napoleon, have expressed a variant of his view that "the spirit is to the sword as three to one." Xenophon (400 B.C.) used the term "stronger in soul," or spiritual strength, to explain a soldier's

successful performance in combat (Rouse, 1947). Battlemind refers to this spirit. It is a combat multiplier.

The conventional name for Battlemind[3] has typically been "combat motivation," and in some cases, "fighting spirit." These names connote an active incentive to fight. During battle, however, the majority of soldiers are faced with fear. Under the influence of fear, motivation to fight is adversely affected. Battlemind is not the simple incentive to fight or combat motivation, but the ability to sustain the will to fight despite fear and other adversity.

The constructs of motivation and morale have been used widely by military psychologists and sociologists to describe why a soldier fights. The construct of fortitude, however, differs from motivation and morale. Motivation is traditionally defined as, "a need or desire coupled with the intention to attain an appropriate goal."[4] During combat, however, personal gain and satisfaction become quite abstract issues.

Morale has been defined as an individual's or group's willingness to perform assigned tasks with spirit, enthusiasm, and confidence. A formidable soldier, however, may function without morale. Many Armies have gone off to popular wars with high morale only to be defeated in battle (e.g., the British at Gallipoli). Many productive individuals exist in organizations with little or no morale.

Motivation and morale are related primarily to human productivity, whereas fortitude is related to courage and resolve in combat. It encompasses far more considerations than an incentive for personal satisfaction and on-the-job enthusiasm. Battlemind, or a soldier's fortitude, resides and springs primarily from the strength of the human spirit.

WHY A SOLDIER FIGHTS—AN EXPLANATION

A soldier's combat behavior lies somewhere between the instinct for self-preservation and personal sacrifice. Both conflicting motives exist simultaneously. One springs from the need for self-realization and the development and survival of one's individuality. The other springs from the subordination of one's safety to the survival and success of one's comrades and unit.

Paradoxically, as a soldier grows in self-worth and personal recognition, he is more willing to take the risks that threaten his survival. As he shares common goals and dangers with his comrades, he is more willing to make sacrifices for them. A soldier's fortitude depends on the degree that both considerations (enhancement and subordination of self) are achieved. This is realized through (a) a soldier's self-realization, and (b) comradeship, which leads to (c) heroism.

A. Self-Realization

The individual aspires to grow, develop, and to fulfill his potential. As his self-perception of value increases, he has more incentive to "persevere as a person" and to sustain his image. This is reflected in what the philosopher Spinoza had referred to as "striving to persevere in our own being."

Self-worth underlies a soldier's self-esteem and resistance to adversity. To the extent that the Army adds value to a soldier through his personal development, it contributes to the goal of self-realization. When the Army recognizes the soldier's accomplishments, it also supports the soldier's self-esteem. A soldier's pride helps to resist anything that threatens his self-image as a good soldier. Pride in self and unit is reflected in the tenacious will of some soldiers to perform well despite the worst of circumstances.

> *But the goal of your quest for knowledge of your self is to be found at that burning point in yourself . . . and therefore desireless and fearless. That is the condition of the warrior going into battle with perfect courage. That is life in the moment. That is the essence of the mysticism of war . . .*
>
> *J. Campbell, 1987*

B. Comradeship

Comradeship results from the association of organized men in the pursuit of a dangerous and difficult goal (Gray, 1959). This appears to lead to a remarkable transformation in the group members through their awareness of an objective to be overcome together. In such situations, the individuality of the soldier is subordinated to a collective will to succeed and the intuitive understanding of communal strength.

When one is sharing his life with his comrades, the reality of death appears to be diminished. There appears to be an instinctive recognition that immortality is achieved through the survival of the group or one's comrades, an unconscious understanding that immortality is related to something that is transcendent of the individual's own mortality.

This phenomenon has been recognized by many writers, as expressed in the following:

> *. . . who came to act on the principle that if the regiment lived it did not matter if they died . . . (Moran, 1966).*
>
> *He is alone, or nearly alone, in his willingness to sacrifice himself for the good of the tribe, or more specifically for his comrades (Richardson, 1978).*

A great deal of emphasis has been placed on the role of cohesion. It is often viewed as the causative factor that leads to a unit's combat effectiveness. Cohesion or the formation of cohort groups, however, does not necessarily lead to purposeful, positive behavior to achieve a common goal. By way of example, a successful football team is the result of "teamwork" driven by a combination of motives for glory and money. Instead, military cohesion may only be the product and not the cause of effective teamwork.

The critical concept is comradeship. Bonding occurs because of shared and difficult combat experiences. Comrades are born through hardship. Bonding is the result of such experiences—not the cause. Battle experience has led to such groups of men. True loyalty results from comradeship. Because of it soldiers will risk themselves for the safety of their comrades.

> *Emotional ties, forged under the severest conditions, between men in a tight knit unit was the single most potent factor in keeping a unit together. Simply put it was love. That love, when fused with some sense of purpose higher than the instinct to survive, is even more powerful.*
>
> *C. MacDonald, 1978*

Essentially, a soldier's fortitude in battle reduces to a moral and volitional issue. He fights as a matter of "conscience," in order not to tarnish what is important to his own being as a person and to his relationship with his comrades.

C. Heroism

Courage leads to heroism. It results from both self-realization and personal sacrifice for one's comrades. Through self-realization the hero discovers his own capabilities. "The conquest of fear yields the courage of life. That is the cardinal initiation of every heroic adventure—fearlessness and achievement" (Campbell, 1987, p.152). Ultimately, it is the adventure of being alive.

Campbell (1987) states that the basic motif of the universal hero's journey is to evolve from the state of psychological immaturity to the courage of self-responsibility and assurance. Can he overcome the dangers? Does he have the courage, the knowledge, the capacity, to enable him to succeed? Ultimately, the achievement of heroic deeds leads to a transformation in the individual, with benefit to others by the example set. The hero's quest develops character as he learns about himself.

Each of the great religions also teach that trials of the hero's journey are a significant part of life, that there is no reward without renunciation. The ultimate plateau of self-development is when we no longer place our own needs first and seek self-preservation, but give or sacrifice for others.

DEVELOPMENT OF A SOLDIER'S FORTITUDE

The construct of fortitude is comprised of a set of soldier attributes. These attributes, listed in Table 1, are organized relative to their association with leader practices, self-realization, and comradeship. The presence of one or more of these attributes may or may not be enough to help provide a soldier with the necessary or sufficient fortitude in battle. Their effects are summative and in certain situations multiplicative, such as when pride and defiance are aroused.

The soldier attributes that underlie fortitude can be developed by the application of the "Battlemind" principles presented below. The application of these principles will make every duty day a training day. Effective individual and unit training, within a disciplined military environment and competent and concerned leadership, will develop the soldier's spirit and unit's elan. The spirit so created will assure a soldier's effective combat performance.

Table 1 ***Warrior Attributes That Comprise Fortitude Organized Relative to Leader Practices, Self-Realization, and Comradeship***
Leader Practices
Discipline . . . responsiveness to orders
Loyalty . . . allegiance
Respect . . . for authority
Confidence . . . in a leader's skills
Self-Realization
Self-image . . . as a brave or courageous warrior
Inner discipline . . . resistance to temptation or expediency in behavior
Dedication . . . tenacity, perseverance, steadfastness to duty
Faith . . . a supporting religious or personal philosophy
Pride . . . satisfaction in achievement and self-respect
Self-confidence . . . as a competent and skilled soldier
Initiative . . . risk taking
Stamina . . . physical strength to resist fatigue
Comradeship
Cooperation . . . recognition of the interdependence and value of comrades
Resolution . . . communal will
Selflessness . . . subordination of personal interest to a common goal

The Battlemind principles were derived from practices used by successful armies over a span of 4000 years, e.g., Xenophon (Rouse, 1947) and Sun Tzu (Clavell, 1983). The principles are organized relative to the Army training model of Leader, Individual, and Collective training. These principles and the soldier attributes to which they contribute are shown in Table 2.

Table 2
Relationship Between Battlemind Principles and Soldier Attributes Relative to Army Training Model

Army Training Model	Battlemind Developmental Principles	Battlemind Soldier Attributes
A. Leader Training		
	1. Authority	Discipline
	2. Stewardship	Loyalty
	3. Integrity	Respect
	4. Competence	Confidence
B. Individual Training		
	1. Soldier Beliefs*	Self Image Inner Discipline
	2. Soldier Worth	Dedication
	3. Skill Proficiency	Pride Self Confidence
	4. Assertiveness	Initiative
	5. Physical Conditioning	Stamina
C. Collective Training		
	1. Teamwork	Cooperation
	2. Challenge	Resolution
	3. Purpose (with challenge)	Selflessness

* Chaplains can play an important role in enhancing soldier faith.

The application of these principles will enable the soldier to

a. find himself, to achieve maturity through self-realization;

b. face trials and challenges with courage;

c. grow in his personal confidence;

d. develop comradeship by sharing and working closely with his teammates;

e. adopt the Army's culture, values, and expectations.

A. Leader Training

Authority. Authority leads to the soldier attribute of *discipline.* While the position/rank of the leader establishes a basis for authority, such authority must be accepted by the individual soldier for it to be truly effective.

The soldier depends on strong leadership on the battlefield which also supports his pride and expectations. The effective leader, whether an officer or a noncom, ensures that his subordinates will respond to orders by exhibiting his own tactical and technical expertise. Rewards and punishments administered by the leader must be clearly tied to discipline, with certainty of punishment when warranted. The leader must also know how to judiciously apply punishment to assure that the spirit of the soldier is not lost.

Stewardship. Stewardship contributes to the soldier attribute of *loyalty.* One of the most important battlemind principles for a leader is the stewardship of his men. Soldiers are his resources in battle. These resources must be developed. By active concern with the welfare and development of his soldiers, a leader earns their loyalty.

A leader's stewardship starts with respect and loyalty to the soldier, including trust and good will. A paternal attitude is not out of place. The emotional needs that one develops from childhood are transferred to one's supervisor. This aspect is particularly cogent for the younger soldier, and often times for persons of any age due to its emotional basis. The attitude must be instilled that leaders have an additional responsibility for their men and not one of extra privilege. It is important to evaluate leaders by how well they employ and develop the natural enthusiasm, initiative, and energy of their subordinates.

Integrity. Integrity contributes to the soldier attributes of *respect* and *inner discipline.* A leader's integrity is one of the key principles underlying Battlemind. Deeply founded values and professional ethics play a role as important as spiritual values, or serve as a substitute for them. The essence of a professional leader is character with ". . . the task of establishing and transmitting values" (Sorley, 1989, p.11).

Integrity assures the adherence to Army values and standards, the courage of one's convictions, boldness and the strength to take chances, and most fundamentally, to do the

right thing (honor) under the stress of battle. Soldiers recognize integrity in their leaders, are attracted to it, and need not be dominated to obtain their compliance to orders. In combat, the bottom line is the loss of one's life. Unspoken questions often are: "Would I want to fight with this person? Could I depend upon him?"

An NCO and officer also personify the culture and values of the Army. As very powerful role models, they contribute to the inner discipline of the soldier. A leader's character is often transparent to the soldier, and hence lack of character can be deleterious to goals of the organization through its impact on the attitudes and morale of the soldier.

Competence. A leader's competence contributes to the soldier attribute of *confidence*. A soldier's confidence in his leader's competence complements his own self-confidence, which supports his willingness and initiative in battle. A leader's demonstrable tactical skills are necessary for the credibility of leadership and the assurance that lives won't be wasted in battle. A leader's competence also helps to create an incentive in the soldier to excel and serves as a role model. The ability of the leader to achieve even limited tactical successes also leads to a major boost in soldier confidence by removing any latent doubts about their capability to win and by deflating any indomitable image of the enemy.

The senior leader also has a role in Battlemind. He can be a rough or refined personality, so long as he embodies strength and other admirable qualities with which the soldier can identify and find personal reassurance. Above all he must exhibit confidence in the success of the battle to be undertaken. Such a leader is a symbol whose visibility at critical times is important.

B. Individual Training

Soldier's beliefs and values. A soldier's beliefs and values contribute to the soldier attributes of *self-image* and *inner discipline*. A person's core beliefs contribute to his value systems, his self-perception, and manner of behavior. Beliefs and values motivate and guide action. When beliefs are shared in a team or larger unit they become a unifying force. They lead individuals and teams of men to take similar actions, and to the expec-

tation of similar action on the part of others who are operating out of contact.

The Japanese kamikaze soldiers were only too willing to die for their emperor due to their beliefs and values. "History reveals the ferocious fanaticism with which men have fought, not only for their religious beliefs, but for different brands of the same faith," (Richardson, 1978, p.44). Whether it is the belief in emperor, or militant social doctrines, or religious dogmas, belief systems have been shown to lead to fervor in battle. Belief systems, however, need not be so extreme. It is the power of deeply held beliefs and values, and not necessarily the extremes of specific beliefs, that serve to influence, and indeed control, a soldier's behavior in combat.[5]

Soldier's self-worth. Adding to a soldier's concept of his self-worth contributes to the soldier attributes of *dedication* and *loyalty*. Enhancing a soldier's concept of his self-worth may be achieved by programs for soldier personal development. Recognizing a soldier's worth by awards and ceremonies contributes to his dedication. The perception that "someone cares," and the implicit respect for the soldier which it connotes, is the foundation for dedication and loyalty.

Some military organizations take pride in "breaking the man to build the soldier." The man they propose to break is often a very young man whose lack of self-confidence is only reinforced. This is counterproductive. The proper goal of military socialization is to build the man and create the soldier. While the former policy may appear to work, there is a price to be paid in the arrested development of some soldiers who can smartly go through the motions, but who have lost individual will and fortitude. The effects of abuse, by their instructors, have been reported in a group as sophisticated as young medical students. The experience ". . . had a long term negative effect on them resulting in inferior learning, lowered self-esteem and less effective patient care" (Altman, 1990).

In some primitive tribes rites of submission were an initial part of a rite of passage. These events were intended to help an individual master himself and to put away his childhood (Jung, 1964, p.156). While such rites have been passed down, they formerly were not necessarily coercive. The critical ingredient is to be "tough and demanding" without dehumanizing the per-

son. A tough and demanding leader can still be fair, well respected, and concerned for the welfare of his soldiers.

People with pride will leave the service rather than put up with hazing for the same reasons they would resist in battle. Other good persons will endure it, but by and large it has no value. This aspect of attrition from the military service and its academies is not often recognized. The tyranny of lesser men—there is no other explanation for it—should not be allowed to hold sway over defenseless enlistees or service members.

Skill proficiency. Progressive skill proficiency leads to the soldier attributes of *pride* and *self-confidence*. When a soldier's skills are developed to progressively higher performance standards, self-confidence, and pride are added. A soldier's awareness of his ability to achieve higher standards contributes to his self-realization and confidence in his abilities. It instills the desire to excel and to maintain his achievement. As a result, the soldier will find that quiet center of confidence in himself around which he can maintain his performance despite stress and other distractions during battle.

Rachman (1978) indicates that "... possession of the appropriate skill level required in the dangerous situation serves to increase courage, and the most important immediate determinant of courageous performance is a sense of self-confidence about one's skills." In the Israeli Defense Forces it was found that 42% of the soldiers with low self-esteem regarding their military skills experienced a combat stress reaction during combat. In contrast, only 5% of the soldiers with a positive self-perception experienced such a reaction.[6]

Soldier assertiveness. The development of a soldier's assertiveness leads to the soldier attribute of *initiative*. Soldier assertiveness is important for initiative and risk taking. Assertiveness is a normal human characteristic. As opposed to inertia, it is the basis for almost every human activity. Confidence underlies it. However, it can be suppressed through harsh discipline and cultural beliefs. Often the lack of will to fight can be a subconscious constraint because of these factors.

An extreme manifestation of this problem occurs when soldiers fail to fire their weapons during combat. Marshall (1947) estimated that only 25% of combat soldiers actually fired their weapons. While there is some controversy about this number,

the reason for not firing is more instructive than the actual number. "The fear of aggression has been expressed to him so strongly and absorbed by him so deeply and pervadingly . . . This is a great handicap when he enters combat. It stays his trigger finger even though he is hardly conscious that it is a restraint upon him" (Marshall, 1947, p.78).

The above behavior is not associated with lack of bravery or fortitude. However, it deserves to be mentioned here as it unconsciously detracts from the soldierly behavior of otherwise brave men. It has been found that such men hold a position no less tenaciously and will die for it, but without firing! As a result, Army training must endeavor to release normal human assertiveness through sports and other means, and to avoid harsh treatment which only leads to moroseness and loss of initiative.

Physical conditioning. Physical conditioning contributes to the soldier attribute of *stamina.* Combat is physically arduous. Fortitude requires active coping and is undermined by fatigue. Soldiers must be in top physical condition to endure the continuous physical demands that will be placed upon them. The development of a soldier's fortitude starts with his physical conditioning.

C. Collective Training

The following principles work collectively in developing soldiers into comrades. They are described separately, however, to present their unique contribution.

Teamwork. Teamwork contributes to the soldier attribute of *cooperation.* There is a synergy, a bonus of energy, that results from the cooperative efforts of individuals. Giving to each other, working for each other, leads to greater mutual benefit, greater ease, and individual development. By working together as a team, special individual skills are developed and coordinated with those of others. The value of cooperation is learned and that otherwise difficult tasks for the individual can be achieved together. While an outstanding soldier can help to energize a group, the benefits of teamwork are more dependable and provide the necessary framework for individual initiative to take place.

The adverse conditions of a battlefield are also beyond normal human capability to endure alone. The soldier in combat

needs and depends on the moral support of his teammates. Personal stress and fear are exacerbated without teammates. The approval and approbation of his teammates are also important for the maintenance of the soldier's self-esteem. The consensus of historians is that "men will fight as units but flee as individuals."

As stated by Straten (1987), "A soldier among strangers has less reason to hide his fear and little reason to worry about losing his reputation. In an intact small group, men . . . are under the same compulsion to keep face and share in the common defense. Individual stragglers, on the other hand, are under no such compulsion."

Paratrooper training places special emphasis upon individual initiative and operating in mixed groups, in case the troopers are separated from their unit after a parachute drop. Marshall (1947) notes, however, ". . . as with other troops their battle morale, willingness, and efficiency are in ratio of their knowledge of men on whom they are depending for close support."

Challenge. Challenge leads to the soldier attribute of *resolution*. Challenging a soldier's courage, as well as mental and physical skills, demonstrates that he has what it takes, the importance of his own skills, and the need for teamwork. Increasingly more difficult scenarios that are successfully accomplished also lead to the bonds of comradeship and a soldier's feeling of "invincibility."

Through resolution and determination a soldier learns that he can do it. The knowledge that "I can do it" or "we can do it" is often the difference between heroic and nonheroic action. The hero or heroes have taken the initiative knowing that they have done it before.

Purpose. Purpose, together with challenge, leads to the soldier attribute of *selflessness*. A purpose, mission, or goal is necessary to direct and focus the behavior of a team. It is the prerequisite for purposeful and positive behavior and for the development of communal will. Without a common goal, crowds or groups of individuals can be more easily herded (e.g., prisoners of war (POWs)).

The goals should be relatively limited in scope and concrete so that they are attainable in the immediate or foresee-

able future. Active goal orientation, expectancy, and a sense of purpose are essential to bring meaning and for assuring the vitality of the team. Together with challenge, purpose welds a team and creates that special chemistry of comradeship and a soldier's selflessness for his comrades.

SPECIAL TRAINING TECHNIQUES

Several of the Battlemind principles are realized through three types of training: skill, maneuver, and challenge training. These successive training levels build upon each other and help lead to the soldier attributes of confidence, pride, cooperation, and resolution. They are described here to highlight them and to show their relationships.

A. Skill Level Training

The principle of progressive skill proficiency, under Individual Training, is achieved by establishing a set of performance standards for each hierarchical level of skill. These standards should then be used as the prerequisite requirement (or gate) before training for the next level of skill proficiency.

Such standards contribute to Battlemind by indicating specifically where the soldier exceeds or falls short of the standard. They provide a training goal and a remedial basis for individual improvement as well as a performance-based reference for building confidence.

Performance standards should be set at progressively higher yet attainable levels. It is important not to set the standards too high but high enough to be realized. The latter helps to assure the steady growth and confidence of the soldier without premature failure and discouragement. The distance between the goals should be gradually increased. The final performance level should represent a difficulty level requiring considerable preparation and effort.

A clear set of performance standards (or gates) prior to each successive level of training will also provide a basis for the allocation of training resources, including time to train. They will enable the cost effective allocation of resources to meet a given standard or help to determine the optimal standard for limited resources.

B. Maneuver Training

The principle of teamwork, under Collective Training, is essentially achieved through maneuver training. Maneuver training refers to active maneuver and simulated fire against real or simulated targets. Such training will focus on all appropriate echelons depending on intent and, when built upon in a sequential fashion, will result in the development of increasingly effective teams.

Maneuver training contributes to the integration and coordination of all team member skills. Moreover, effective maneuver and gunnery skills are vital to team and soldier confidence, as well as tactical successes which further reinforce the soldier's confidence.

Two notable examples of maneuver training exist. They are (1) the Precision Range Integrated Maneuver Exercise (PRIME) System, an active tank maneuver course with simulated fire and shoot back targets, and (2) the Multiple Instrument Laser Engagement System (MILES) for simulated infantry engagement exercises. The National Training Center (NTC) and the Combat Maneuver Training Center (CMTC) represent higher organizational levels of maneuver training with increased emphasis on command and control.

C. Challenge Training

The principles of challenge and purpose, under Collective Training, are primarily realized through challenge training.[7] It represents a critical training level for the development of Battlemind. Challenge training must contain (1) a specific and tangible goal and (2) the presence of some form of danger or extreme challenge. Its purpose is to challenge a soldier's courage, as well as mental and physical skills, to succeed and to help demonstrate that he has what it takes to succeed.

The goal in challenge training must be specific and concrete to facilitate the exercise of common will. Extreme challenge is necessary to assure the need for will and resolution to succeed. The element of extreme challenge and/or danger also helps to arouse the instinct for group survival and comradeship.

To meet the above requirements, the training should provide (1) analogous "trial by fire" experiences, embedded within realistic goal-oriented operational scenarios that require will

and the need to overcome challenges, and (2) situations that help to elicit elemental human emotions associated with combat such as stress, fear, and the need for courage.

Challenge training will require the development of special scenarios tailored to the branch of the Army involved (e.g., Infantry or Armor), including obstacles, challenges, and team activities. Mountain climbing, in the sports domain, represents an analogy to this type of training.

This type of training should not be confused with adventure training, simulated fantasy-like experiences, or obstacle courses designed for the individual. It is battle focused, performance oriented training that challenges a soldier's skills and emotions in a team context.

ARMY APPLICATIONS

The development of Battlemind principles can only be done effectively within the context of Army values. The Army is a unique institution whose success depends upon a value system based on dedication, unity of purpose, and sacrifice. An Army's values represent the foundation for its strength and the framework for its operating and combat effectiveness. Values establish the organizational climate necessary to bring out the desired characteristics in soldiers and to assure their fortitude.

An Army without values, or values motivated only by the self-interest of its members will, like any other institution, lose its vitality and become subject to discord and turmoil. Ultimately, an Army's combat performance depends upon its institutional values, its culture, and the expectations of its members. A clear statement of Army values is needed if the fortitude of its soldiers is to flourish.

The development of specific Army applications based on Battlemind principles belongs at the appropriate command level and must take into account local requirements and conditions. A comprehensive example of Battlemind applications can be found in

> "Battlemind Guidelines for Battalion Commanders," April 1992, issued by General Crosbie E. Saint, Commander-in-Chief, U.S. Army Europe.

Other human dimension issues that should be addressed during training are methods for the reduction of a soldier's stress in appropriate situations and the conservation of his resources during sustained operations. These considerations are presented in the following field manuals

FM 22-6, "Management of Stress in Army Operations," December 1983.

FM 22-9, "Soldier Performance in Continuous Operations," December 1983.

EXPECTED ARMY BENEFITS

Battlemind is a combat multiplier. The development of a soldier's fortitude through the application of Battlemind principles during training will contribute to

A warrior spirit

Maximum combat effectiveness

Increased survival in battle

Increased initiative

Reduction of combat stress reactions

Survival as POW

SUMMARY

The Army is a unique institution of men under arms. By virtue of its purpose and training, a soldier's courage is vital to its success. A soldier's fortitude is not assured in combat unless the principles for its development are formally recognized and applied during training. An Army's strength ultimately resides in the spirit of its soldiers, rather than in its numerical and technological superiority alone.

In view of ongoing force restructuring, the challenge of the 90's will be the creation and maintenance of smaller, lighter, and extremely mobile maneuver forces that deploy on short notice. Such forces can be made even more formidable through the understanding and application of "Battlemind" principles.

Notes

1. The male gender is used for ease of expression.

2. This text adopts the convention of William James that "fear" is present when the "bear" *is* charging you, while apprehension or anxiety occur when you *anticipate* that you might encounter an angry bear.

3. The term "Battlemind" was coined by Maj. M. Sedlak, III Corps.

4. Kretch, D., & Crutchfield, R. S. *The Elements of Psychology,* Alfred A Knopf. New York, 1958.

5. An important aspect of Battlemind is its "spiritual foundation," which is an integral component of a soldier's beliefs and values. Satisfaction of the need for spiritual growth is pervasive in mankind due to an intuitive awareness of one's spirit and its relationship to a creator. This need, and the development of a spiritual foundation, should not be confused with some of the fanatical dogmas mentioned above. Faith, and the love with which it is associated, helps turn away fear and doubt. A strong spiritual foundation leads to the soldier acquisition of *faith.*

6. Personal communication with Col. (ret.) Dr. R. Gal, Israeli Institute for Military Science, 1992.

7. The concept of challenge training was recommended by Dr. Kent Williams, Virginia Polytechnic Institute & State University.

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SECTION IV

Future Opportunities and Needs for Army Training

The papers that follow provide some initial research findings as well as more futuristic views regarding training of units.

While conducting rigorous and realistic training at home-station is desirable for a variety of reasons, the likelihood that all units will be provided with sufficient resources to carry out such training during times of fiscal austerity is low. To address this problem in resourcing for training exercises that require OPTEMPO, the Army has embarked on a major program that would utilize Distributed Interactive Simulation [e.g., SIMNET and the Close Combat Tactical Trainer (CCTT)] as adjuncts to field training.

The paper by Meliza, Bessemer, and Hiller of ARI presents initial research findings addressing the use of Distributed Interactive Simulation (DIS) to assess unit performance for the purposes of providing training feedback and usable research data. The authors demonstrate how an After Action Review in which participants can identify key exercise events, decide the causes of these events, and develop ideas for specific corrective actions, works within the context of an electronic battlefield.

The paper by Lieutenant General (Ret.) Brown is reproduced in part from a report entitled *Training Third Wave Landpower: Structured Training*, prepared under contract to the Institute for Defense Analyses for the Advanced Research Projects Agency. The paper goes beyond ongoing research and develops a new paradigm for the training and development of tomorrow's Force Projection Army. This paper presents a strategy for using both analog and digital simulations, for the training and exercising of battle staffs to achieve effectiveness in a wide range of combat scenarios.

In the epilogue to this book, Hiller identifies a need for a modified unit readiness reporting system that links training accomplishments to required resources. Such a modified system should, according to Hiller, take into account the myriad variety of missions that America's Army will face and the danger to readiness of reduced resources.

Providing Unit Training Feedback in the Distributed Interactive Simulation Environment

Larry L. Meliza,
David W. Bessemer, and
Jack H. Hiller

THE AFTER ACTION REVIEW (AAR)

This paper provides a window into the technology of the future for unit training—Distributed Interactive Simulation or DIS. In DIS, individual weapons systems are re-created as simulated systems which provide the human weapons system interfaces that are sufficient for soldiers to mount and operate the simulated weapons systems. The radical technological innovation in DIS is the networking together of the individual weapons simulators so that each weapon system's behavior is tracked and fed into all of the other simulators. The effect of the networking is to produce an interactive, real-time simulation that provides a highly effective simulation of units conducting combat operations—moving, shooting, and communicating. The original DIS system was SIMNET, and the unit performance measurement system (UPAS) described in this paper was initially designed and tested for SIMNET. The success of UPAS has led to its adoption by the Simulation, Training, and Instrumentation Command (STRICOM) for implementation now being procured.

The goals of collective training, regardless of the form of training, e.g., on the ground with real weapons systems or in DIS, are to develop the capabilities of individuals to work together as a team and teams to work together as part of a larger organization. Cognitive learning theory has argued that the best approach to training views the learner not as a sponge that passively absorbs information from which knowledge and cognitive skills are automatically generated, but instead views the learner as an active agent that works to interpret new information by relating that information to the individual's existing personal knowledge. Feedback to the individual on the success

of the individual's efforts to learn and on his understanding are critical for establishing the validity of the individual's construction of new knowledge.

The AAR is the Army's preferred method of providing feedback after collective training. The AAR is an interactive process in which exercise participants discuss mission planning and execution under the guidance of an AAR leader (Scott, 1983; Scott and Fobes, 1982; Meliza, Sulzen, Atwood, and Zimmerman, 1987). During an AAR, exercise participants analyze exercise events to discover the causal factors affecting mission outcomes so they can learn from their mistakes and successes.

The AAR should focus on critical events having a direct influence on mission outcome (Scott, 1983; Scott and Fobes, 1982; Meliza et al., 1987), because linking such events to mission outcomes increases the validity of corrective actions in the eyes of exercise participants. For example, a platoon's mission might be to provide covering fire for a unit conducting an assault. If the platoon did not provide adequate covering fire to prevent the enemy from inflicting heavy casualties on the assault element, then it failed its mission. During an AAR, the platoon might find that it did not start firing on the enemy until too late in the assault. Further discussion may lead to the conclusion that the tardiness was due to the fact that the platoon was not in a position to observe the start of the assault, and the unit's plan did not provide a mechanism for coordinating the timing of suppressive fires with the start of the assault. The AAR, in this case, points the way to specific corrective actions. In comparison, if the platoon were told merely that it failed to provide covering fire, then the needed corrective actions would not be so readily apparent.

In preparing for an AAR, the leader identifies critical events that made substantial contributions to mission outcomes and estimates unit strengths and weaknesses that might have led to these events. During the AAR, the leader guides the discussion to ensure that key events and their causes are discussed. Ideally, the leader will have AAR aids to illustrate key events and their causes. In the example of a platoon providing covering fire for an assault element, these aids might include an animated replay showing one unit assaulting while the supporting unit sits, not firing, and a map display of terrain visible to the supporting unit from their position.

TRAINING DEVICE INNOVATIONS THAT FACILITATE AARS

Three training device innovations have facilitated application of the AAR concept: realistic simulation of weapon effects, instrumented ranges, and Distributed Interactive Simulation (originally implemented by the Army as SIMNET and currently in the process of expansion through procurement of the CCTT). These innovations combine to facilitate the AAR concept by providing a credible mission outcome around which an AAR can be developed, employing electronic data that can be used to prepare AAR aids, and increasing the opportunity for units to train by reducing the cost of training.

The Army's move toward realistic simulation of weapon effects in force-on-force exercises began with REALTRAIN (or Scopes) and continued with the MILES. Weapon system simulations with real-time casualty assessment techniques used in field training exercises are termed "engagement simulation" methods. REALTRAIN employed a procedure whereby numbers on the helmets of enemy soldiers or vehicles had to be identified (using scopes affixed to weapons) and called out by the firing element in order for a casualty to be assessed by an exercise controller. MILES replaced this cumbersome system with eye-safe lasers and detector belts. The use of engagement simulation helps to ensure there are credible outcomes of exercises on which to base an AAR.

The development of instrumented ranges was the second innovation to support the AAR concept. Instrumented ranges, such as the Army's National Training Center, use telemetry to collect time-tagged position location, firing event, and casualty data from vehicles on a nearly continuous basis. The benefits of these ranges can be better appreciated when one considers the cost of collecting these time-tagged data using full-time observers. The REALTRAIN validation for Armor/Anti-Armor units required an observer to collect data on each vehicle in the exercise and a mapper to follow each unit (Scott, Meliza, Hardy, Banks, and Word, 1979). Such a large commitment of personnel to data collection was necessary but is no longer cost-effective.

The networking of combat vehicle simulators in the DIS environment was the third innovation to support the AAR concept (U.S. Army Armor School, 1989a; Thorpe, 1988). The initial application of DIS, Simulation Networking, was developed

by the Defense Advanced Research Projects Agency (DARPA) and included simulators for Armor and Mechanized Infantry vehicles (Thorpe, 1988). Information produced by each simulator, such as its location on the terrain data base and the target location of each firing engagement, is broadcast over a network in the form of Protocol Data Units (PDUs) and picked up by other simulators. Using broadcast data and data from a common terrain data base, computer graphics generators with each simulator are able to construct real-time "out the window" pictures of the battlefield for each gunsight and vision port in each vehicle simulator.

DIS facilitates the AAR process in two ways in addition to providing engagement simulation and enabling instrumented data collection. First, it allows the frequency of training to be increased by making training more affordable. Since DIS does not employ operational equipment, it provides savings in terms of fuel expenditures and reduced wear and tear on operational equipment (as well as creating a safe training environment). DIS requires fewer personnel to support training exercises, because Semi-Automated Forces (SAFOR) can be used to play the role of both threat forces and friendly forces (Mullally, Petty, and Smith, 1991). Second, DIS offers enhanced data collection capabilities because the training exercise takes place in an electronic environment. DIS provides automated data on firing events and location, but with much greater precision than is practical to implement on instrumented ranges. Unlike instrumented ranges, DIS also provides automated data on such variables as fuel levels, ammunition levels, weapon system orientation/trigger pulling time, and engine speed throughout an exercise.

DIS also has specific current limitations. SIMNET lacks capabilities required to train certain collective tasks included in ARTEP Mission Training Plans (Drucker and Campshure, 1990; Burnside, 1990). For example, it does not allow soldiers to alter terrain (prepare defensive positions), and it does not include machine guns for armored vehicles (cover killing zones and suppress dismounted troops).

THE NEED FOR NEW TOOLS TO SUPPORT THE AAR IN THE DIS ENVIRONMENT

SIMNET has two powerful tools for observing exercises and showing replays of unit performance during AARs: a Stealth Vehicle that provides an "out the window view" of the action from any point on the battlefield, and a Plan View Display that allows the action to be observed from a "bird's-eye view" (Thorpe, 1988).

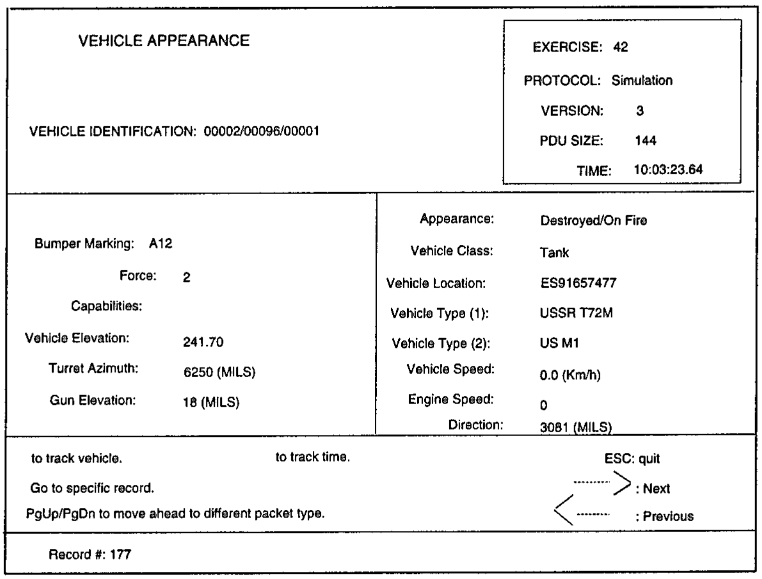
However, as originally developed by DARPA, SIMNET did not include the programming required for efficient conduct of the AAR. SIMNET training sites, such as the Fort Knox Combined Arms Tactical Training Center, included only a Single Plan View and Stealth to monitor exercises and host AARs, while multiple exercises are often conducted concurrently. SIMNET training sites have not provided the means for replay of network data such as display summaries of unit performance measures. Trainers must recall when critical events occurred in order to navigate through the entire stream of data recorded for each exercise, and when an exercise has run for a few hours, as is typical, the search task may be monumental. Based on the need that ARI identified for supporting the near-real-time conduct of AARs after SIMNET exercises have been run, ARI organized and funded the necessary research and development program (Hiller, 1987). This program became known as the Unit Performance Assessment System, (Meliza, Bessemer, Burnside, and Shlechter, 1992). The UPAS has been designed to support efficient conduct of AARs by providing programming for replaying selected battle segments and for displaying associated performance measures and summary statistics.

NETWORK DATA COLLECTED BY THE UPAS

To fully appreciate the potentials and drawbacks for providing feedback in the DIS environment, one must be aware of the types and volume of network data within a SIMNET exercise. These data are sent over the network in the form of Protocol Data Units (PDUs). These PDUs are the mechanism by which the various simulators communicate information to one another. The types of PDUs collected by the UPAS are described below.

- The Vehicle Appearance PDU provides information needed to continually update the position and appearance of each vehicle in SIMNET. The information about each vehicle includes IDs, force identifier, elevation, turret azimuth, gun elevation, the appearance (alive or burning), type, location, speed, engine speed, and orientation. Figure 1 illustrates what one of these packets looks like when viewed through the UPAS Packet Display feature.

Figure 1. Sample Vehicle Appearance Packet from a SIMNET exercise.



- The Vehicle Status PDU contains information about a vehicle other than that required to simulate its outward appearance. This information includes fuel volume, number of ammo rounds, odometer reading, vehicle type, and ratings of the mobility, fire power, and communications status of the vehicle as operational or nonoperational.
- The Fire PDU identifies the target (if known), type of ammunition, firing vehicle ID, gun muzzle location, number of rounds fired, and the rounds fired per second.

- The Indirect Fire PDU identifies the firing vehicle ID, type of ammunition employed, number of rounds fired, location of impact, and result of the impact.
- The Impact PDU describes the ground or vehicle impact resulting from a firing event in terms of impact location, distance from muzzle to impact, number of rounds, number of rounds per second, ID of firing vehicle, type of ammunition, and ID of target (if PDU describes a vehicle impact).
- The Status Change PDU describes changes in vehicle status due to tactical or administrative actions by identifying the vehicle affected, reason for change, vehicle causing the change (if appropriate), and the nature of the change.

DESIGN REQUIREMENTS

Before describing UPAS data displays it is useful to describe the major issues that guided development of the UPAS. Many of these concerns are either unique to the DIS training environment or more critical in this environment.

First, one must integrate network data with non-network data to provide more complete descriptions of unit performance. Information about the specific mission, enemy, friendly troops, terrain, and time (METT-T) is needed to interpret casualty and position location data collected during exercises (Kerins, Atwood, and Root, 1990; Hiller, 1987). The importance of integrating other types of data is illustrated by Table 1, from Meliza, Bessemer et al. (1992). This table shows the frequency with which various data sources and combinations of data sources are used in applying performance standards from the Army Training and Evaluation Program Mission Training Plan for Armor Platoons (Department of the Army, 1988). The table addresses those categories of data sources which account for at least two percent of the standards from the MTP document, including just those standards supported by SIMNET (Burnside, 1990). Only 10% of the standards can be applied using network data alone.

Second, the UPAS should be flexible enough to allow displays to be modified easily without major reprogramming of software. The military still has very limited experience applying

DIS to training, and little data are available that can be used to justify detailed formats for measurement outputs in terms of their utility to users. ARI viewed the UPAS as a prototype that would allow researchers and trainers to try out different output formats and make prompt changes in response to these try-outs.

Table 1
Data Sources Used in Applying Armor Platoon Mission Training Plan Standards Supported by SIMNET

Data Sources	**Percentage of Standards Using Data Source**
Observations	16%
Network	10%
Network + Communications	10%
Network + Terrain	9%
Communications + Observation	8%
Communications + Observation + Planning	7%
Observation + Planning	7%
Communications	6%
Network + Planning	5%
Network + Planning + Terrain	5%
Network + Observation	3%
Network + Communications + Planning	2%
Network + Communications + Terrain	2%

Third, ARI was concerned with developing a performance measurement system to help link training in the DIS environment with that at the Army's National Training Center as part of a total training system (Kerins, Atwood, and Root, 1990). One of the main reasons for linking the two environments is to support the use of SIMNET as a method for preparing units to maximize the value of their NTC training, and another is to use SIMNET to address training needs identified in their most recent rotation to the NTC.

Fourth, ARI was concerned with filtering exercise data to facilitate data processing (Meliza, Tan, and Bessemer, in preparation). A tremendous number of Vehicle Appearance PDUs are generated when exercises have large numbers of vehicles (e.g., a company echelon force-on-force mission) and/or a high de-

gree of movement. The network data load can be so large that a Personal Computer-based data collection system cannot keep up with it, causing the loss of irreplaceable data. All of the PDUs collected, except for the Vehicle Appearance PDU, contain at least some information that is not duplicated. Even if all the PDUs from an exercise can be collected, the large amount of data associated with Vehicle Appearance PDUs can slow down the data analysis process.

Fifth, a need exists to provide data displays as soon as possible after DIS exercises. There are no maintenance tasks for units to perform after DIS exercises and fewer administrative tasks in comparison with field exercises. Therefore, there are few requirements to keep units occupied while trainers prepare for AARs. Trainers within the Fort Knox Combined Arms Tactical Training Center requested that the UPAS be capable of supporting AARs within a few minutes after an exercise.

Sixth, to encourage use of UPAS, ARI had opted for an affordable PC-based system.

DATA CONVERSION TO A RELATIONAL DATABASE

Employment of a relational database provided a method of addressing, at least partially, all of the needs identified above. A decision was made early in the development of UPAS to employ two separate data files for each exercise. One database includes the sequence of PDUs collected from the network used to drive the replay of an exercise and associated map displays. The second is in the form of relational data tables used to support the preparation of graphic and tabular data summaries.

The UPAS draws the raw data from the network and loads them into a relational database. Once the data are in this database, they can be analyzed by non-programmers using Structured Query Language (SQL). Further, the UPAS includes Graph and Table Editors to help implement menus of graph and table options.

The use of this database and associated editors offers flexible data analysis capabilities. Users of the UPAS can change data displays generated from the database, based upon lessons learned about the utility of these displays.

The design of this database is patterned after the NTC Archive database developed for ARI by Science Applications International Corporation, the Jet Propulsion Laboratory, and BDM, successively, and thus is referred to as the SIMNET/NTC database. In terms of the number of data tables, the SIMNET/NTC database is a subset of the NTC Archive database. For example, the NTC database contains a Minefield Casualty Assessment Table that is not included in UPAS. On the other hand, certain of the SIMNET/NTC tables in UPAS contain information unique to SIMNET (e.g., tank main gun orientation). Table 2 shows the information contained in the Ground Player Location Table. Items with an asterisk are unique to SIMNET.

Table 2
Contents of the SIMNET/NTC Ground Player Location Table

- time of vehicle status update
- player bumper number
- logical player number
- position of vehicle
- position of vehicle relative to origin of the terrain database *
- vehicle speed *
- vehicle direction *
- gun elevation *
- turret azimuth *
- engine speed *
- odometer reading *
- total amount of ammunition *
- amount of fuel left in vehicle *

There is a major benefit to a common NTC/SIMNET database design. It supports efforts to relate SIMNET and NTC training and associated performance measures. That is, it helps to transfer methods for analyzing unit performance in one environment to the other environment. Although the NTC database is designed to include all combined arms elements while SIMNET currently lacks all weapons systems, the UPAS

database will readily accommodate the addition of missing combined arms elements that are planned for inclusion in DIS.

The relational database also played an important role in helping to filter exercise data. The utility for loading the relational database gives the user the option of selecting the interval for entry of data from the Vehicle Appearance PDUs. If, for example, the user selects a five-minute interval, the data will be loaded once every five minutes for each vehicle. This feature affects the Ground Player Location Table only. Data from other PDUs are not reduced in any way.

Finally, the relational database proved to be a useful tool in terms of integrating data from different sources. In addition to network data, the UPAS relational database contains unit control measures from the unit's operations order (OPORD) and some radio communications data. These data must be collected by an observer and loaded into the database. The communications data are then included automatically with network data and control measures in an Exercise Timeline display. Control measure data are also integrated with terrain data and network data to support replay of the exercise and other map displays.

UPAS DATA DISPLAYS

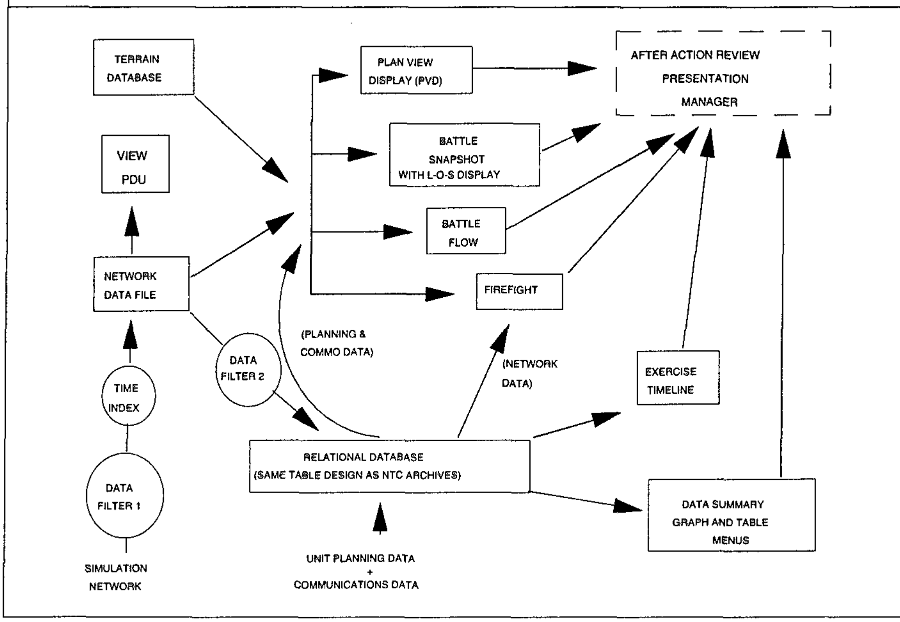
Figure 2 provides an overview of the UPAS. The Plan View, Battle Flow, and Battle Snapshot are map displays that use data packets collected from the network together with terrain data, while the Exercise Timeline and Graph or Table menus use data from the SIMNET/NTC database. The Fire Fight Display is a hybrid map display that combines data from the SIMNET/NTC database with terrain data. Each of the types of data displays are described below. The displays are illustrated using data from an exercise in which a REDFOR platoon of manned simulators attacked a BLUFOR platoon of manned simulators.

Map Displays

The UPAS provides four types of electronic maps: the Plan View, Battle Snapshot, Battle Flow, and Fire Fight. Each electronic map shows a bird's-eye view over a grid map with terrain features and unit control measures from the unit's operations order. Each kind of map feature is presented in a different color. UPAS includes panning and zooming capabilities that al-

low the user to focus on a particular part of the battlefield or back off to show a larger area. Each electronic map also allows the user to decide whether to include terrain features in the display and whether to display elevations, and to set the contour interval.

Figure 2. Overview of major components of the UPAS.



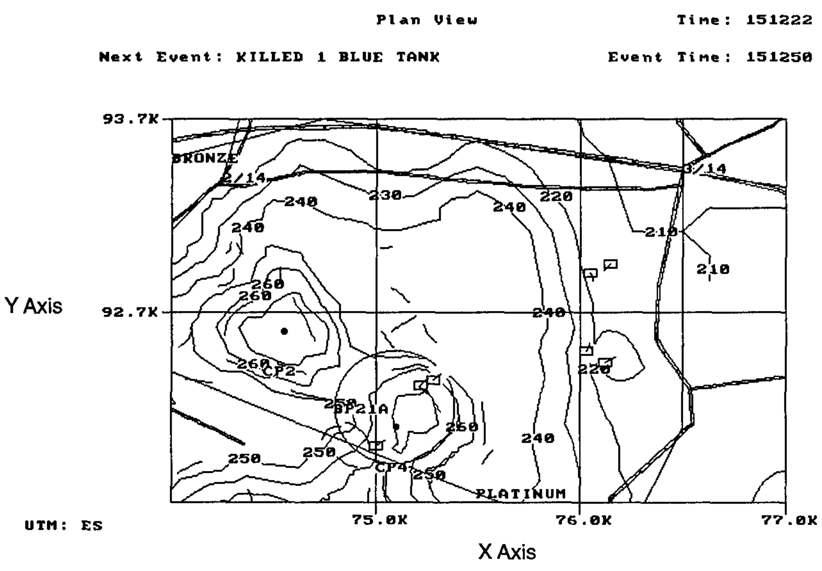
Plan View Display

The Plan View shows a second-by-second animated replay of an exercise. It shows movement of individual vehicles and the orientation of gun tubes. REDFOR vehicles are red and BLUFOR are blue. Vehicle icons brighten briefly when a vehicle fires, and they change color permanently when a vehicle is destroyed (REDFOR to white and BLUFOR to cyan).

The Plan View allows the user to move directly from one point in the replay to another. The Plan View is also integrated with a Master Event List function that allows the user to type in key time-tagged events from the units OPORD and/or events observed by a trainer during an exercise. This integration makes it possible to jump directly from one key event to another without viewing less informative periods of the exercise.

Figure 3 is an example of a Plan View screen showing the REDFOR platoon leader and his wingman attacking from the north (south of Phase Line Bronze) and the BLUFOR Platoon Sergeant and his wingman using a tree canopy for concealment. At this point in the replay both sides have already fired at one another, and the lead section of the REDFOR continues to attack against a concealed BLUFOR. This display might be used to guide discussions about actions the REDFOR might take to reduce its vulnerability to BLUFOR fires.

Figure 3. Example of a Plan View Display with terrain contour lines, surface features, operational control measures, and tanks.



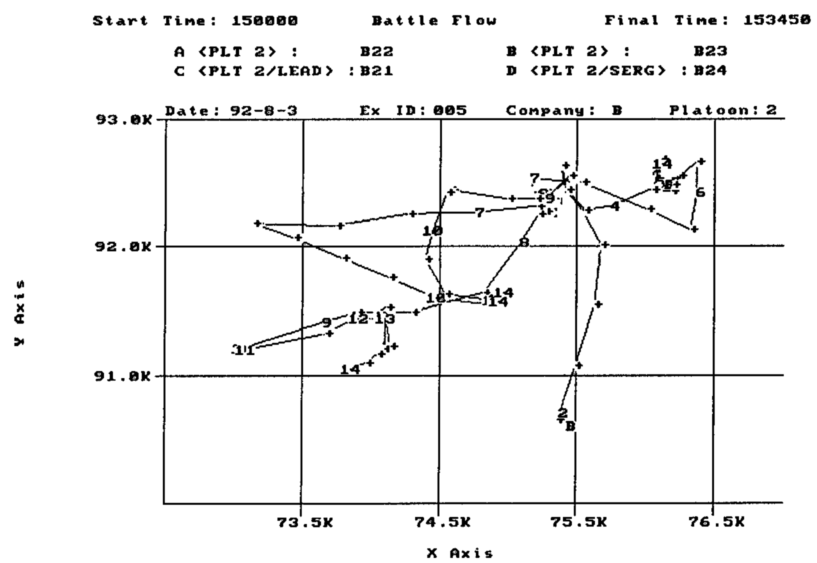
Battle Flow

A Battle Flow traces movement of vehicles throughout a mission or during critical segments of a mission. The user selects the period to be addressed by a trace, as well as the intervals at which positions are to be marked. When large periods are covered, the Battle Flow can provide a picture of a unit's overall movement to use in assessing how effectively it navigated towards the objective, applied movement techniques like bounding overwatch, and followed control measures. For exam-

ple, one might use a Battle Flow to find out if a unit crossed a specific control measure by the time specified in the OPORD.

Figure 4 is an example of a Battle Flow showing movement of a defensive BLUFOR platoon. This trace includes a withdrawal from a Battle Position (BP) during which two of the vehicles became lost. This display might help to guide discussions about map orientation, the importance of fighting as a unit, and maintaining the integrity of the platoon. Discussions might cover such points as the reason for each change of position, whether the various crews were aware of the location of other friendly vehicles, and whether the unit leader was aware of the moves.

Figure 4. Battle Flow tracing movement of each tank in a BLUFOR platoon during its defensive mission. Terrain contour lines and surface features are omitted.



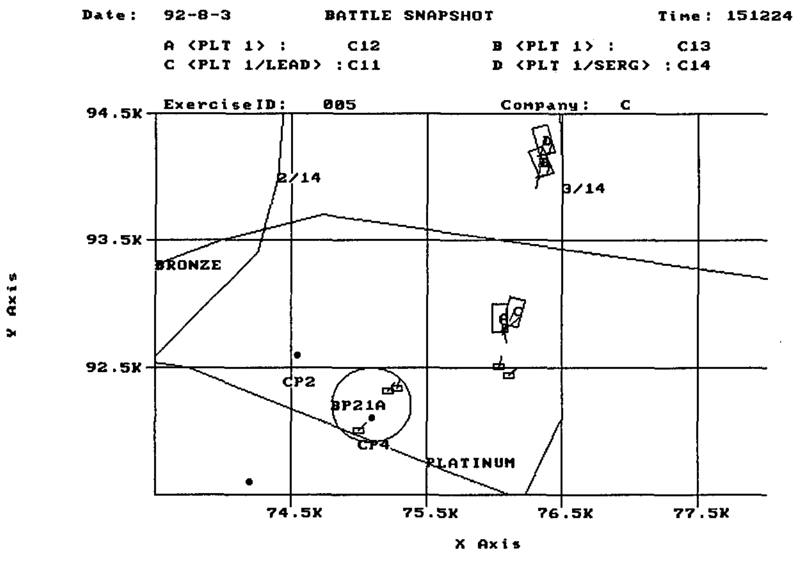
Battle Snapshots

Measurement potentials of moment-by-moment replays are limited by the amount of information that can be contained on screen when position and firing data have to be continually updated. A transitory presentation also does not lend itself to close scrutiny of detail. Snapshots provide a way to gain detailed information about the tactical situation. The Snapshot

provides a color-coded display that shows bumper numbers, the locations of the platoon leader and sergeant, positions of vehicles, and their gun tube orientation at specific moments. Enemy vehicle icons are much smaller and provide less detailed information about the enemy.

Figure 5 is a Snapshot of a REDFOR unit in which the platoon sections separated. While the color-coding cannot be illustrated, the platoon leader and his wingman are in the immediate vicinity of enemy vehicles, while the remainder of the REDFOR platoon is about 1500 meters to the rear. This display might be used in discussing masking of the trailing section's fires by the lead section as well as other topics.

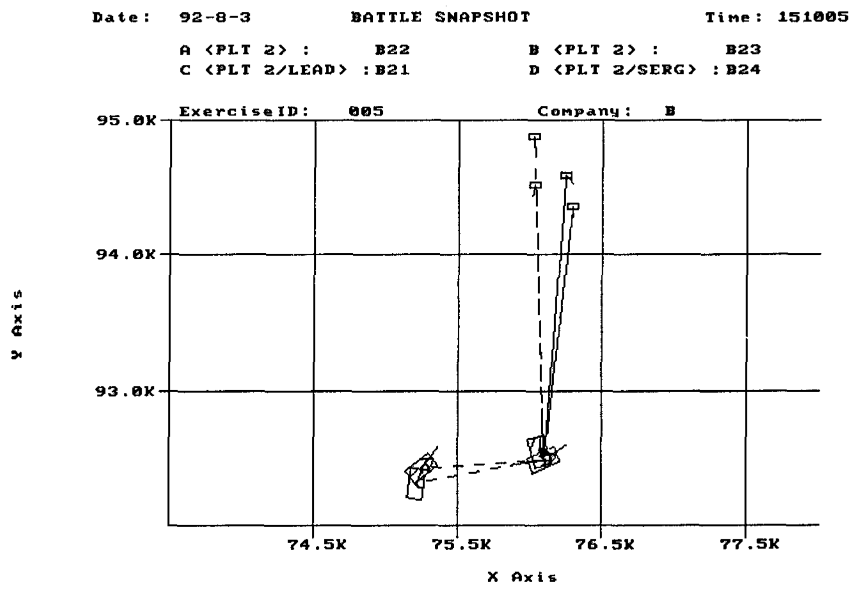
Figure 5. Battle Snapshot with terrain surface features showing a REDFOR platoon as the lead section approaches defenders in a canopy-covered wooded area.



The Snapshot also has the capability to show line-of-sight (LOS) between friendly and enemy vehicles. LOS between two vehicles is indicated by an unbroken green line, while lack of LOS is indicated by a broken red line. This feature can be used to assess the concealment offered by a unit's halt positions, battle positions, and routes.

Figure 6 is an example of a Battle Snapshot showing BLUFOR vehicle B23 has intervisibility with two attacking REDFOR vehicles. It also shows the gun tube of B23 is pointed away from the advancing enemy force. These observations are important because B23 does not begin firing on the enemy until five minutes later in the exercise. This display might be used to guide discussions about why B23 did not engage the REDFOR. It might also be used to discuss actions a crew might take to increase its surveillance activity, such as continually scanning its sector.

Figure 6. Battle Snapshot showing line-of-sight between a BLUFOR vehicle and two REDFOR vehicles.



Summary Tables and Graphs

UPAS menu-based table and graph editors are used in combination with SQL to create menus of table and graph options. Once a new table or graph has been "defined" using these editors, its name is added to the menu of tables or graphs available to all users of the UPAS. When an option listed on a menu is selected, the UPAS automatically prepares it.

Table 3 is a UPAS data table showing firing events as a function of time, side (REDFOR or BLUFOR), and bumper number. This table shows that BLUFOR vehicle B24 engaged a REDFOR platoon for over four minutes before another BLUFOR vehicle became involved in the action. A review of UPAS tables showing the effects of firing events and ranges of engagements for this exercise showed that tank B24 was destroyed at 15:12:45 when a round was fired by tank C12 at a range of 80 meters.

Table 3
Firing Events by Time, Side, and Bumper Number

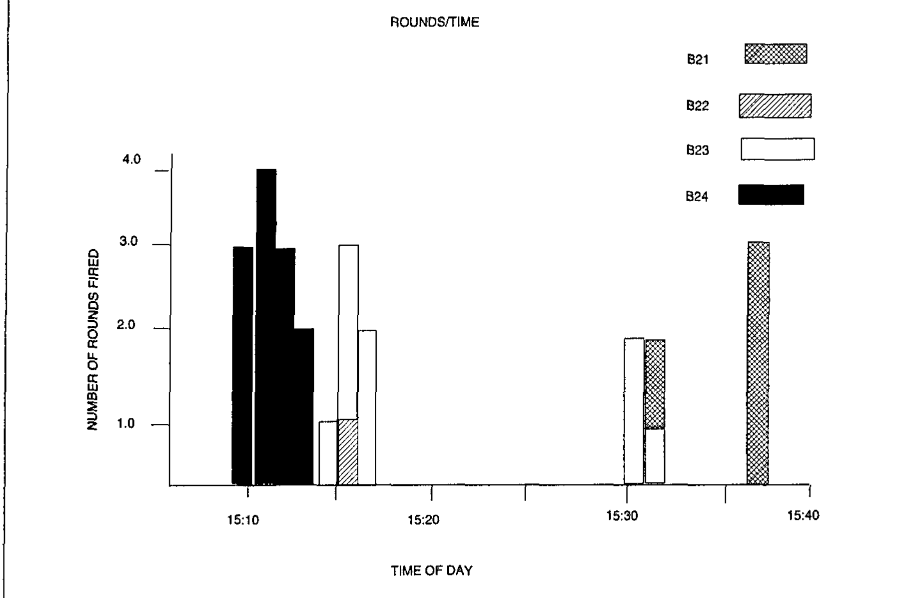
Time	Side	Bumper #	Time	Side	Bumper #
15:09:27	B	B24	15:11:22	R	C12
15:09:46	B	B24	15:11:22	R	C13
15:09:57	B	B24	15:11:26	B	B24
15:10:16	B	B24	15:11:27	R	C14
15:10:28	B	B24	15:11:34	R	C13
15:10:39	B	B24	15:12:22	B	B24
15:10:48	B	B24	15:12:26	R	C14
15:10:49	R	C14	15:12:31	B	B24
15:10:55	R	C11	15:12:35	R	C13
15:11:00	B	B24	15:12:36	R	C12
15:11:12	B	B24	15:12:45	R	C12
15:11:14	R	C12	15:14:37	B	B23

This display might be used alone or in conjunction with the Battle Snapshot in Figure 6 to discuss why tank B23 and the other BLUFOR tanks failed to fire until long after tank B24 fired. These discussions might identify such problems as a lack of communication between the platoon sergeant's section and the remainder of the platoon. The overall outcome of the discussion might be a new platoon SOP that ensures the platoon will be able to bring as much fire as possible on enemy forces.

Figure 7 is one of the UPAS graph options. This figure shows the number of rounds fired by the BLUFOR unit as a function of time. It is obvious from this figure that the mission involved two separate engagements from the perspective of the

BLUFOR, with the engagements being separated by roughly twenty minutes.

Figure 7. Graph of rounds fired by BLUFOR vehicles over time.

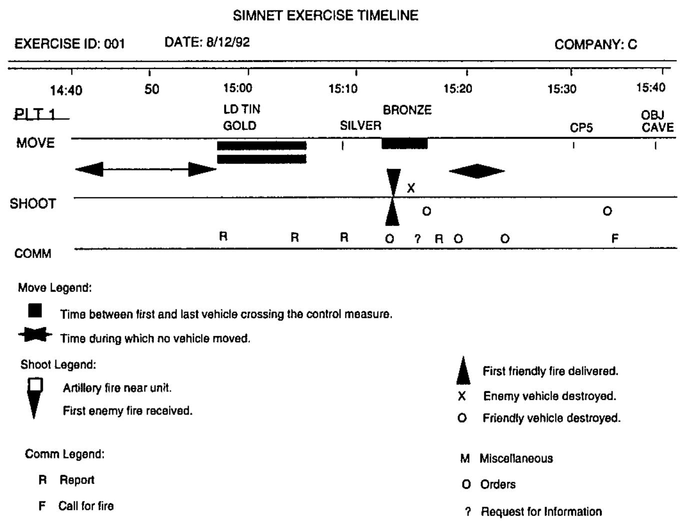


Exercise Timeline

To make effective use of various UPAS map displays, a user needs to know when critical events occurred during an exercise. An Exercise Timeline is prepared at platoon level using data from the relational database. For a company team level exercise, a separate timeline is prepared for each platoon, the company headquarters (commander and XO), and an attached platoon. The Timeline includes lines for movement, shooting, and communication events. The movement line shows when a platoon crosses a control measure or comes to a halt. The shoot line shows when a unit first receives direct fire, first delivers direct fire, destroys an enemy vehicle, sustains the loss of a vehicle, or receives indirect fire. The communications line shows message types. An "o" indicates an order, a question mark indicates an information request, "r" indicates a report, "f" indicates a call for fire, and "m" indicates the message does not fall within any of the other four categories.

The example in Figure 8 is for the REDFOR platoon engaged by the defending BLUFOR platoon mentioned previously. The time for leaving the assembly area and crossing the Line of Departure (LD) are the same, because the LD was right next to the assembly area.

Figure 8. Exercise Timeline.



Several minutes were required for the platoon to cross the LD and Phase Line Bronze. The leader crossed the LD and moved one kilometer ahead of the remainder of the platoon before the remainder crossed. In crossing Phase Line Bronze, the platoon leader and his wingman moved forward, while the other two tanks stayed behind temporarily. This splitting of the unit occurred after both platoon sections had been engaged by the BLUFOR platoon sergeant. Note also that the platoon halted many minutes after the initial engagement, rather than halting immediately. The platoon leader's tank was disabled, forcing him to transfer to one of the two vehicles that remained undamaged.

The Timeline serves two broad functions. First, it identifies times that might warrant examination during replays. For example, the time when a unit first receives or delivers direct fire might be examined to find out if the unit was moving in a protective posture when it made contact with enemy. Second, the Timeline serves also as a tool for examining collective perfor-

mance. If few reports are made, the commander may probe for information as indicated by requests for information. If a unit is not crossing its control measures on time, then a problem in collective performance has been identified. If that same unit is also coming to halts frequently, then the user may have identified the cause of the problem.

One of the major benefits of the Timeline is that it can be used to examine coordination among movement, shooting, and communication events. For example, all of the movement and shooting events in the Timeline should be associated with a report. If a unit is halted when it receives indirect fire, it should report and move out promptly. These are only two examples of patterns of behavior that can be examined looking across the movement, shooting, and communication lines.

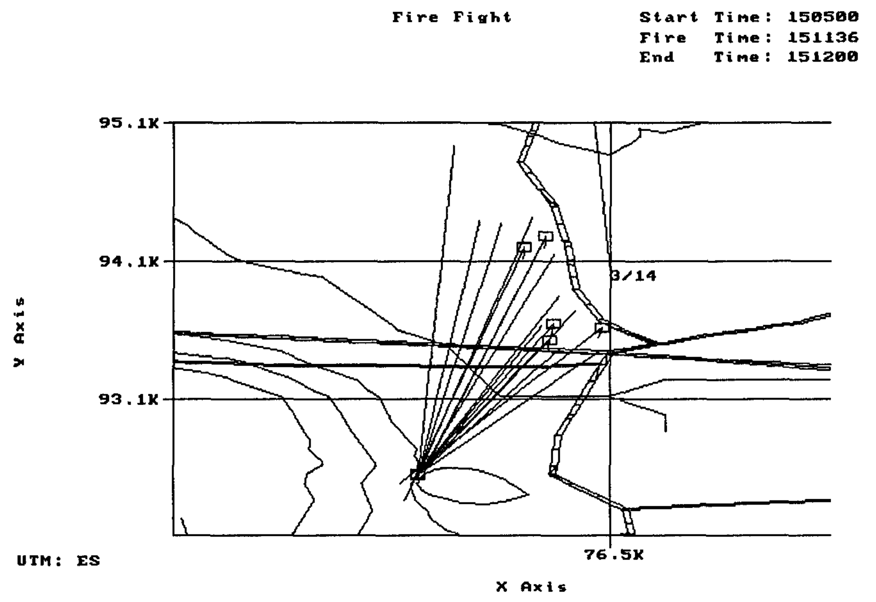
Fire Fight

A Fire Fight Display (Figure 9) shows direct and indirect firing events over a terrain map. The period in time covered by this display is user selectable so that it can cover an entire exercise or a critical portion of the exercise. The Fire Fight can be used to assess whether vehicles fired within their assigned sector during defensive missions. It can also be used in any exercise to decide whether fires are directed towards enemy vehicles and whether direct and indirect fires are being concentrated. The Fire Fight can also be used to decide if a unit shifts its direct and indirect fires away from a position that is being approached by other friendly elements.

Direct firing events are displayed with shot lines connecting the location of the firing vehicle with the location of the vehicle or ground impact. A vehicle icon is used to show the location of the firing vehicle using the same color coding system as the Plan View. A miss is indicated by a white line, and a green line indicates a hit or kill. If the firing event results in a kill, there will also be a dead vehicle icon at the target location (cyan for a destroyed BLUFOR vehicle and white for a destroyed REDFOR vehicle). Artillery impacts are shown using white rectangles.

Figure 9 shows paired firing events during the period in which BLUFOR vehicle B24 engaged the attacking REDFOR in the absence of other BLUFOR fires. Artillery did not impact in the area shown during the time period covered by the display.

Figure 9. Example of a Fire Fight Display.



On the positive side, the color-coded form of this display shows that fires from B24 hit REDFOR vehicles on four occasions during this period. On the negative side, the display indicates B24 did not change positions during this period. Discussions guided by this display might concern the importance of "shooting and scooting" after a tank gives away its position by firing at the enemy and the benefits of massing direct and indirect fires to suppress the enemy.

AAR PRESENTATION MANAGER

Effective use of UPAS data displays to support an AAR requires the AAR leader to move quickly and smoothly from one display to another. This means that many of the displays have to be created before the start of the AAR because of the time required to construct certain of the displays.

Army trainers who participated in UPAS development clearly indicated the desire to use an animated replay as the focal point for the AAR. They wanted the capability to call up other types of displays at will during the replay to emphasize key points.

The AAR Presentation Manager concept is currently being implemented within the UPAS. This feature will allow the user to save static screens of interest (e.g., a graph of fires over time) and call these screens up while using the Plan View. The Presentation Manager will also allow the user to type comments as screens are saved, and the comments will be displayed along with the saved screens. The major thrust of future refinements in DIS AAR systems should focus on further reductions in the time required to prepare for an AAR.

Future developments in UPAS will incorporate data collected by trainers as they observe and listen to units training. To facilitate data collection and processing, notebook size computers, i.e., electronic "clipboards," will be programmed, based on the tasks in the ARTEPs.

SUMMARY

An effective AAR is one in which participants identify key exercise events, decide the causes of these events, and develop ideas for specific corrective actions. Training in the electronic battlefield of DIS makes it possible to record data on vehicle location and firing events to illustrate a wide variety of key events. These "events" might include outcome measures (casualty exchange ratios, the area occupied or controlled by a unit at the end of an exercise) and process measures.

Examples of process measures based solely on firing and location data include the number of rounds of fire per minute used to suppress or destroy the enemy, the number of vehicles within each unit contributing to the fire, and the type of formation in which a unit was moving when it made contact with the enemy. Such measures begin to explain exercise outcomes and help point the way to specific corrective actions. For example, inadequate suppressive fire might be due to the fact that only one vehicle fired on the enemy during the first critical minutes after contact was established.

The addition of terrain data, unit planning data, and radio communications data further expands the types of key events that can be identified and illustrated. For example, the case might be that only one vehicle from a platoon returned fire when contact was made for the simple reason that only one vehicle was positioned to observe the enemy. Continued lack of

involvement of the remainder of the platoon might be due to the fact that the unit was unaware of the details regarding contact, because the contact was not reported over the radio net.

The UPAS is able to collect data from a DIS network and integrate these data with terrain, planning, and radio communications data to provide data displays that can support AARs. Admittedly the UPAS does not provide all types of critical data, because it does not address data that can be gained only through direct observation of soldiers (e.g., checking to see whether the unit leader questions his subordinate leaders to make sure they understand the unit order). At present, information of this sort is carried into the AAR in the memories of exercise participants, but in the future it will be collected by electronic clipboards to support AARs.

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A New Training Paradigm[1]

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Current Army training doctrine was proven in tough operations from Just Cause to Desert Storm to Provide Comfort to Restore Hope. The Systems Approach to Training (SAT) used to develop training is fully accepted, and the capstone training infrastructure is present in the Combat Training Centers (CTCs). New training support technologies have been created and conceptually related in the comprehensive formulation of Tactical Engagement Simulation (virtual, constructive, and real). Where there have been gaps in doctrine, aggressive commanders have compensated. For example, new Battlefield Operating Systems (BOSs) were specified to respond to new training requirements generated by the United Nations operation Restore Hope in Somalia.

All this is commendable, the product of years of dedicated thought and considerable resources. Yet there are insufficient detailed models showing how the various training aids can be combined to maximum advantage in average units. What should be trained in simulation to take advantage of digital information technologies? When should on-the-ground (analog) training be used?[2] When and how to transition from analog to digital (or the reverse) for individual, staff, or unit collective training? This paper proposes a new paradigm to address the training policy issue of how best to take advantage of emerging training technologies.

NEW SITUATION:

A new situation prevails:

- Evolving warfighting doctrine is generating new multi-echelon training requirements. For example, brigade or above fire support capabilities mandate a Brigade Observation Plan, often executed by a Company FIST positioned by Brigade to lase the desired target at the proper time. Just as the introduction of the TOW in the Rifle Company generated a training requirement that could only be addressed with bat-

> talion-level resources, new Full-Dimensional Operations capabilities mandate at least brigade presence to ensure training realism for mounted forces. Battalion, company, and platoon echelon presence is necessary but not sufficient to train some BOSs at battalion and below.

But the issue is even more complex today. Third Wave warfighting presents increasing requirements for direct, immediate application of combat power, from very high echelons to the small unit. Combat information generated at the strategic echelon may be supplied to respond to urgent information requirements from the lowest echelon tactical units. The Fire Support Officer at battalion may call for nearly immediate fire support assets from higher echelons for effective counterfire. When and how does he train with those assets to develop the responsive, trained team? The same training challenge exists for the brigade Electronic Warfare (EW) Staff Officer generating Quickfix or Guardrail support from corps and division. When and how does this EW "team" train vertically so that they can be responsive to increased battle tempo?

New vertical training requirements across BOSs appear. Increasingly, deliberate, often costly structuring of training is necessary to create the warfighting conditions necessary for effective training to occur. Are there vertical (by BOS) as well as horizontal (by echelon) "Tips for the Trainer" to indicate when digital or analog training is appropriate and to describe which tasks must be learned to mastery levels for effective training on other tasks to occur? Thus, new training issues and challenges have emerged.

- Many Divisions are deployed continuously. Division chains of command are in operational mode with their individuals, staffs, and units deployed in several countries simultaneously. In the "world of CNN," these are high-risk operations where the price of incompetence is global notoriety. These new and challenging missions, however, are taking place alongside the mandated and necessary diversions, such as Reserve Officer Training Course support, Total Force training readiness, and unit professional development. Training and warfighting mentoring of brigade and battalion commanders, staffs, and sub-

ordinate units is becoming increasingly difficult. The training environment that generated, validated, and justified FM 25-100, *Training the Force,* has changed. There is, and can be, no reduction of the fundamental unit chain of command responsibility to train subordinates, but commanders in the "force projection" Army need additional training support to assist them in the execution of their training responsibilities. Which exercises should be provided, when, and in what media, to support unit professional development?

- Resources available for training have been and will continue to diminish. Due to the increased number and diversity of missions, less time is available to train to mastery on any one mission. In addition, there are fewer dollars for mounted and aviation forces, particularly for analog training, which is characterized by high OPTEMPO costs. When training is funded, new environmental and safety limits restrict "full up" training associated with the lethality and tempo of Third Wave war. Lastly, terrain limitations preclude training to new battlespace dimensions at most divisional posts. This problem is magnified as new requirements for multi-service and joint force training arise. Digital training can be distributed at far lower cost than analog, so what *must* be analog?[3]
- Horizontal integration of battle systems is clearly necessary for fighting Third Wave engagements and battles. But introduction of horizontal integration brings new capabilities and training aids similar in scope to those provided in the seventies and eighties by the original fielding of the "Big Five." There is now a major challenge for the assimilation of digital technologies (hardware and software).[4] The M1A2 with Individual Vehicle Information System (IVIS) presents new training challenges. Each tank commander provided with different IVIS software has a unique task list that should be trained to fully "fight" the Armored Fighting Vehicle. Also, add the Commanders Independent Thermal Viewer and the improved Gunners Primary Sight. Some vehicle

> commanders (perhaps 30 percent) command subordinate units simultaneously. Now add real-time integration of Scout or Infantry Bradleys and FISTs and perhaps attack aviation. The result: complex and demanding training requirements. To this we should add the issue, What levels of commander/leader task proficiency are required to survive the stress of combat, and how are we to attain and sustain these levels?

As new tactics, techniques, and procedures are created to capitalize on new capabilities in lethality, survivability, and tempo, genuinely new individual and collective task training requirements are created. Some can be trained in simulators, such as the Unit Conduct of Fire Trainer or Platoon Gunnery Trainer, but others must be trained in the field using live fire in bad weather or with actual forces moving on terrain with full battle friction. The question remains: Which, when, and for what purposes?

- Despite the need for "new" training approaches based on "new" weapons systems capabilities, conditions, and situations, there exists a considerable training infrastructure available to be reshaped to meet new training requirements. The CTC complex is a proven operational (and priceless) national asset. The OPFOR is regarded as a credible foe. Observer controllers (O/Cs) are respected mentors. The CTC instrumentation systems permit reflective data analyses from battles. A major investment has been made in Tactical Engagement Simulation, particularly virtual simulation (SIMNET, later CCTT). Now, commercial exploitation of the fusion of communications, education, and entertainment ensures low-cost distribution of the digital-based training—initially nationally, but then globally. The force projection Army seeking joint and combined training proficiency should be able to capitalize on these new technologies.

As a result of the significant training infrastructure available to the US Army, including unit members' acceptance of the validity of the various training experiences, significant change can be effected by policy changes without requirements

for major resource reallocations. No other nation can approach this fielded capability. How can we best take advantage of this situation?

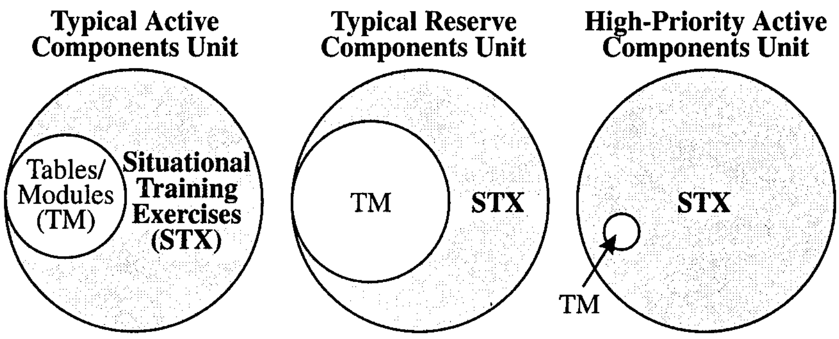
CHARACTERISTICS OF A NEW TRAINING PARADIGM

"New" is a relative term. Army training doctrine, training support, and practice isn't "broke." For all of the reasons discussed above, it is necessary, but not sufficient, for the new training requirements of a Third Wave force projection Army to address a number of key concepts. Several concepts that may aid in expanding the current training framework found in FM 25-100 follow:

- Create repetitive training situations designed to cue specific individual, staff, or unit behavior using TES (Tactical Engagement Simulation) or Training Aids, Devices, Simulators, and Simulation (TADSS), both digital and analog.
  - ❑ Train individuals, small units, and staffs (staff officers and small staff teams) to standard using common training exercise Tables (for units) and Modules (for staffs and individuals), followed by Situational Training Exercises (STX) for likely mission-essential battlefield tasks. Both are required—standard Tables/Modules to ensure baseline task proficiency as well as the highly flexible STX to develop ability to improvise under great stress, a unique characteristic of the American soldier. As indicated below, the ratio between the two may vary greatly based on the type of unit and/or the training proficiency of the individual, staff, or unit. The Table/Module governs training until baseline proficiency is established.

Tables and Modules train "the basics." As rapidly as possible, the unit should transition from Table to STX, through "What If" and "What Then" modifications to Tables. This levers the very considerable training support (e.g., TES) required to create the Tables in order to support the objective structured training and the conduct of STX for the unit's Force Projection METL.

Tables and STX in Army Training



The diagram above portrays units. The same ratios could apply to staffs or to individuals either in the schoolhouse or in the unit.

- Individuals, units, and staffs are trained initially in Tables/Modules not only on what and why but also on "how to" execute their warfighting responsibilities. In Tables/Modules, they are provided "a way" the various tasks are executed to standard by a competent individual, unit, or staff—and they are provided an AAR of "a way."[5] The purpose is not to constrict "your way" or how you as an individual, staff, or unit would respond on the battlefield but rather to ensure proficiency in the "basics" of employing assets consistent with appropriate doctrine, tactics, techniques, and procedures. This approach stresses demonstration of basic abilities in the Tables/Modules followed by innovation in STX.
- Use distributed Tactical Engagement Simulation to ensure quality training to standard. Virtual simulation is shaped to enable/ensure standardization as well as to provide uniform-quality structured training. The strength of virtual simulation is the capability to recreate battle situations in great detail with apparent verisimilitude. For the first time, identical training situations appropriate for individuals, staffs, and small units can be executed globally, thereby providing simulations of common baseline warfighting experiences.

  - To support assimilation of the new capabilities of horizontal integration, leveraging assets such as high-potential officers and noncommissioned officers can be trained/evaluated to a "mastery" level of proficiency on new Third Wave digital hardware/software.[6] Their proficiency can also be assessed regularly in immersion-based evaluations distributed and presented as warfighting vignettes on the ground (analog) and in virtual (digital) simulation.[7]
- Structure the training to provide a seamless progression of exercises.
  - Exercises should flow from crawl, to walk, to run, to rerun; and from analog (small unit drills and STX on the ground in home station), to digital (virtual simulation, CCTT, home station), back to analog (Force on Force/Live Fire-NTC), and then back to digital (virtual simulation, CCTT, home station).[8]
  - Train small units (squad to battalion/brigade (bn/bde)) and battle staffs to baseline "minimum" proficiency in Tables/Modules using TES at home station. Above baseline proficiency, the units and staffs should probably conduct "what if" or "what then" STX derived from the Tables/Modules in order to advantage the very considerable training support provided with the Tables/Modules.
  - Validate proficiency (bn/bde) at the NTC, JRTC, and CMTC for mounted forces. For Active Duty maneuver company and below, validate proficiency at home station; or for Reserve Forces, at the Reserve Component Regional Training Centers.
  - Train to mastery level in Tables/Modules or STX using TES in post-CTC training at home station.[9] The initial development objective for mastery level could be consistent performance to standard on "run" exercises for individual, staff, or unit.
  - Use performance as a basis for the AAR. Compare "your way" (how the unit executes) to "a way"

(how a highly competent unit executed a comparable Mission, Enemy, Troops, Terrain, and Time (METT-T)), so the focus of training can be end performance as well as process-based task performance.

- Design small unit training and Battle Command Staff Training to immerse all participants in a logical sequence of warfighting situations which flow through Pre-Exercise, Context, Table/Module, and AAR, followed by "What If" or "What Then" STXs, to projected battle METL. This flow should be consistent (same Tables and other events) from digital at home station, to analog at CTC, then digital again at home station. The first Force on Force (analog) exercise at the CTC validates baseline proficiency developed at home station (armory or local training area for RC) for individuals, small staffs, and small units. Subsequent CTC missions lead the individual, battle staff team, and unit to as high a level of proficiency as possible in analog training (Force on Force and Live Fire). The culmination of the CTC experience is recommendation of early post-CTC mastery-level training using TES at home station.[10] The rate of increase of difficulty is determined by unit performance at the CTC.
- Presumably there is some validation of individual, battle staff, and small unit proficiency at home station by the division chain of command before conducting training at a CTC. In effect, the CTC phase of the flow of training serves as the microscope or "reality check" of the adequacy of the largely TES-based battalion and brigade training at home station for the unit chain of command. Then, the Take Home Package transitions the unit from analog back to digital with STX or Tables/ Modules in virtual simulation that is recommended for individuals, staffs, or small units based on their CTC performance.[11]

MODIFY TRAINING RESPONSIBILITIES TO REINFORCE THE PARADIGM

The revised framework capitalizes on our new abilities to distribute quality training in virtual simulation and to intensify the training experience through immersion in stressful training experiences. It also leverages the extant training support infrastructure found at the CTCs (Instrumentation, OPFOR, O/Cs). Policies and programs that could be adopted to increase the return on this sizable investment include[12]

- Use Tables/Modules in TES to establish uniform, baseline warfighting proficiency-based evaluation for the individual, staff, and small unit (i.e., the "CTT" or "gate" in warfighting vignettes for the Mech Infantry company team, S2, S3, or Fire Support Officer (FSO) team). These would be modified based on combat operations or CTC experiences.[13]
- Formalize the continuing development of the warfighting competencies of the O/Cs by establishing the CTCs as tactical Schools of Advanced Military Studies (SAMSs)—schools of application or graduate studies in applications of landpower at the tactical echelon.
- Tie the CTCs closer to units by CTC support of TES pretraining through visual exercises demonstrating lessons to be learned (TV initially, then virtual simulation-based "a way" Tables/Modules) as well as suggested "a way" Tables/Modules for mastery-level training post-CTC rotation. In effect, there could be near-continuous communication between tactical units and the CTC via data tapes for the CCTT (eventually Combined Arms Tactical Trainer (CATT)).
- Employ CTC "a way" Tables and Modules (vertical and horizontal) to introduce new capabilities, such as horizontal integration to fielding units in a warfighting New Equipment Training Team environment. The structured training "a way" Tables/Modules and AARs demonstrate tactical use of the new capabilities. In effect, the normal flow of training is used to introduce the "new."

- Charge the tactical SAMSs to prepare "a way" keyed to the METT-T of operational theaters of operations with updates reflecting battlefield lessons learned—visual, immersing structured training for pre-deployment training—via an "Information Age" Center of Army Lessons Learned (CALL). These "a ways" should involve both joint and combined operations reflecting likely mission requirements of the regional CINCs.

Clearly, there are emerging opportunities to use training support (e.g., TES) and training development (structured training) to tie the CTCs to home station training more effectively for force projection training readiness. Once this tie is created, including the counsel of O/Cs with respect to both the requirements and techniques of training, the chain of command should be better prepared to identify training tasks and allocate training resources. That is, there should be more and better information to make training task allocation decisions within the unit and to justify training resource requirements. In effect, the paradigm serves to tie the unit chain of command better to the considerable expertise of the CTC O/Cs for improved individual, staff, and unit training.

The framework presented by this paradigm provides information to the commander to permit him to decide what to train, when to train, and with what training support and is presented as a viable model for organizing training for Third Wave War.[14]

Figure 1. A new paradigm.

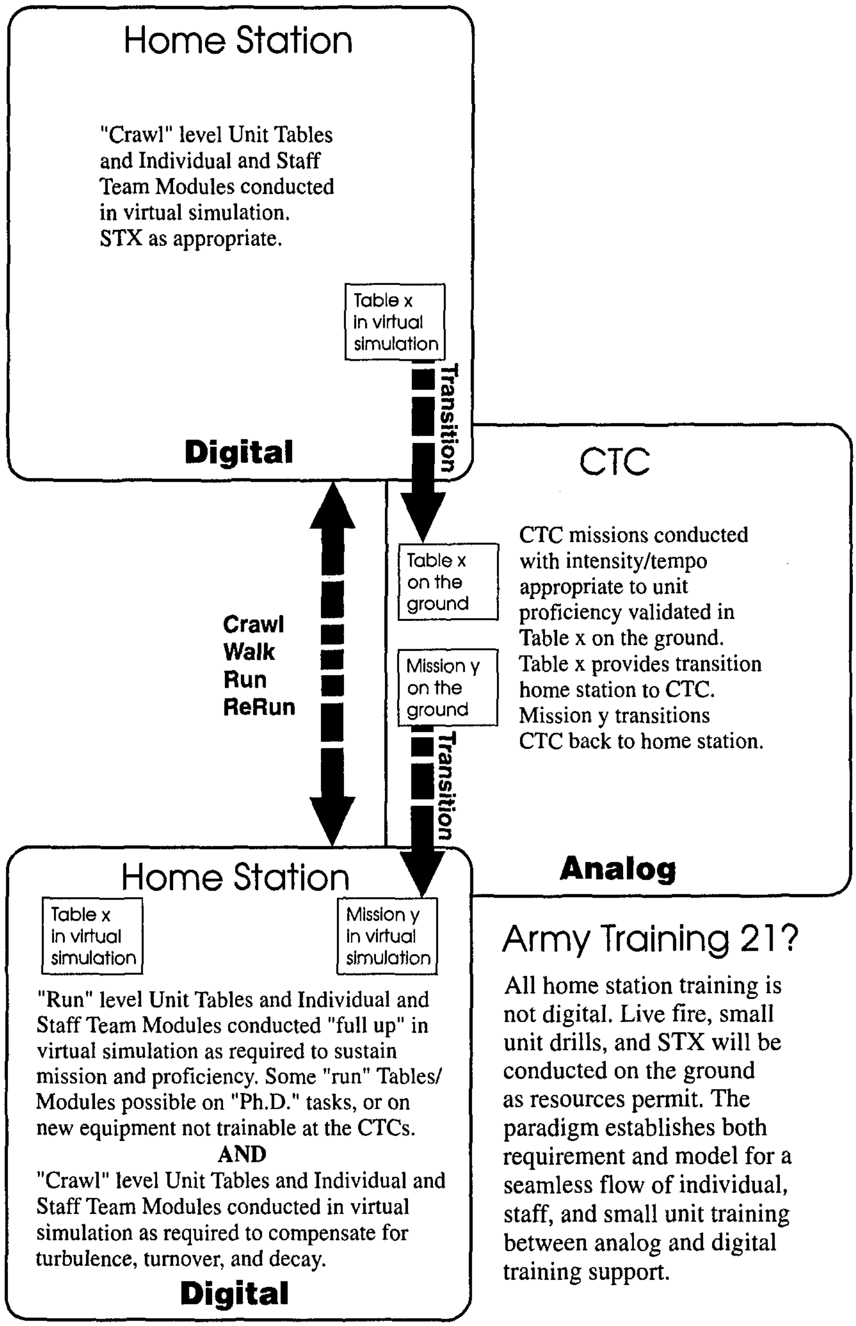


Figure 2. Pre-CTC phase of the cycle.

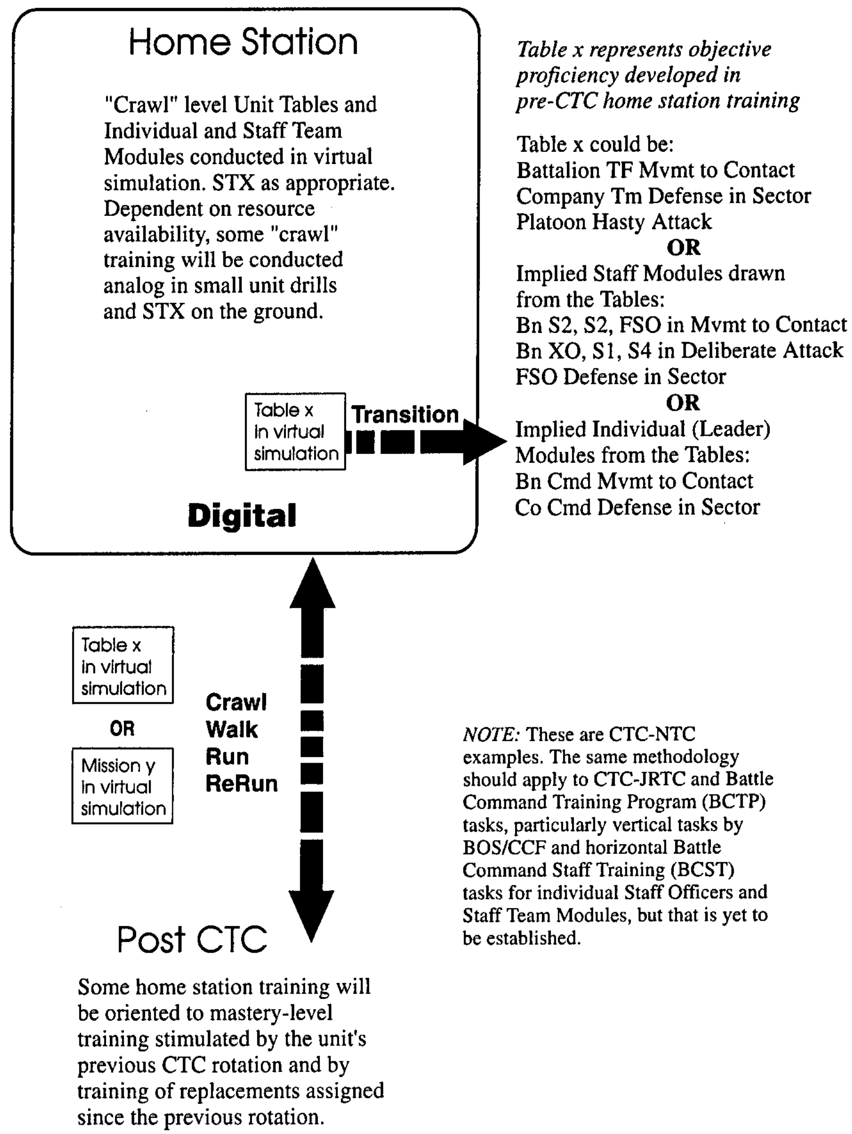


Figure 3. CTC phase of the cycle.

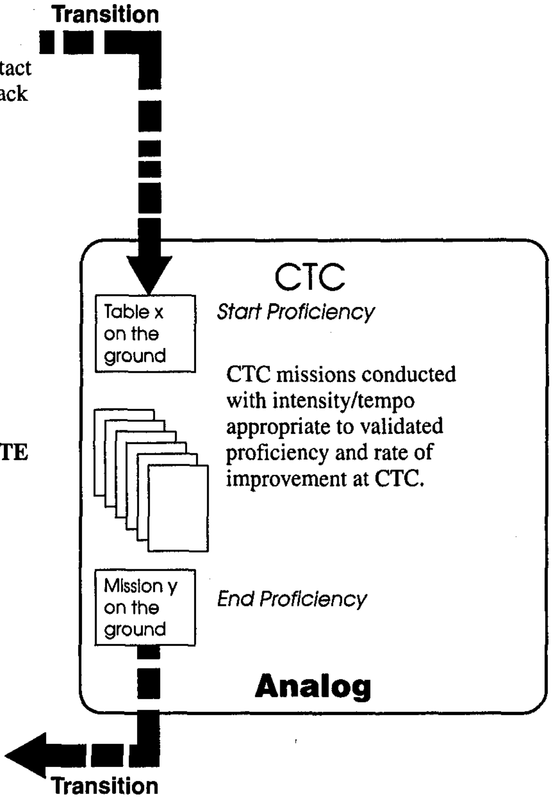
Table x could be:
Battalion TF Mvmt to Contact, or
Company Tm Defense in Sector, or
Platoon Hasty Attack

OR

Implied Staff Modules drawn from the Tables:
Bn S2, S2, FSO in Mvmt to Contact
Bn XO, S1, S4 in Deliberate Attack
FSO Defense in Sector

OR

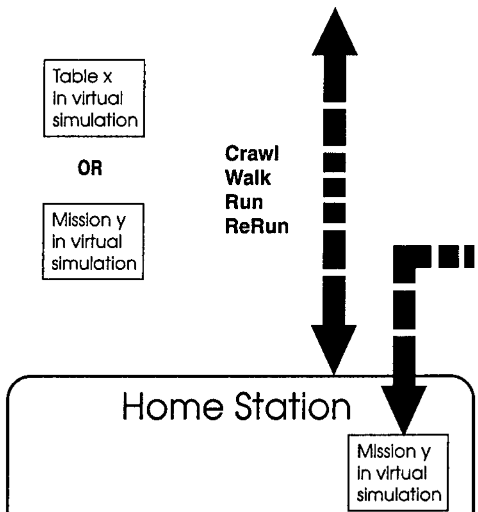
Implied Individual (Leader) Modules from the Tables:
Bn Cmd Mvmt to Contact
Co Cmd Defense in Sector



NOW EXECUTED ON THE GROUND AT THE CTC AS FIRST MISSION TO VALIDATE PROFICIENCY IN THE CTC "CRUCIBLE"

Mission y represents the end state of small unit, individual, and staff proficiency developed at the CTC. It "pushes" the unit as far as resources, safety, and ecology will permit. Mission y will be different for every unit; that is, for a number of good reasons, each unit completes the CTC process at a different level of individual, staff, and small unit proficiency. That proficiency is both the starting point for more intensive training back at home station and the baseline to sustain despite turnover.

Figure 4. Post-CTC phase of the cycle (also called Pre-Next CTC).



"Run" level Unit Table and Individual and Staff Team Modules conducted "full up" in virtual simulation as required to develop full mission proficiency. Some "Run" Tables/Modules possible on "Ph.D." tasks, or on new equipment not trainable at the CTCs.

AND

"Crawl" level Unit Tables and Individual and Staff Team Modules conducted in virtual simulation as required to compensate for turbulence, turnover, and decay.

Digital

Mission y represents the end state of small unit, individual, and staff proficiency developed at the CTC. It "pushes" the unit as far as resources, safety, and ecology will permit. Mission y will be different for every unit; that is, for a number of good reasons, each unit completes the CTC process at a different level of individual, staff, and small unit proficiency. That proficiency is both the starting point for more intensive training back home station and the baseline to sustain despite turnover, turbulence, and learning decay.

Mission y in virtual simulation could be:
Battalion TV Mvmt to Contact, or
Company Defense in Sector, or
Platoon Hasty Attack
AND
Implied Staff Modules drawn from Mission y execution
AND
Implied Individual (Leader) Modules from Mission y execution.
In effect, Mission y can become Run Tables and Modules for subsequent home station training.

This cycle is not "either/or" at home station training. Some Crawl and Run in digital will be conducted as some Walk is ongoing in local analog lanes. The cycle paradigm locates each in a logical, rational continuum of individual, staff, or small unit training.

The training support challenge is to translate Mission y on the ground to Mission y in virtual simulation back at home station and to transition the CTC STX into training Tables responsive to the training requirements of the chain of command, i.e., Tables and STX at the Mastery or Run level while some small units, staffs, or individuals recycle to Crawl to train replacements.

Notes

1. This paradigm is intended to propose "a way" for individuals, staffs, and small units to advantage emerging training technologies to execute the principles of evolving Army training doctrine.

2. There is a challenging requirement to provide guidance to the chain of command as to what can and should be trained, when, with what training support, and then how to provide appropriate training resources. For example, some important warfighting tasks can be trained only in virtual simulation due to cost, or to environmental or safety considerations. However, virtual simulation is a scarce resource requiring thoughtful allocation and responsive training guidance. That guidance is yet to be provided.

3. A theoretical answer is that the training must be "full up on the ground"—that is, analog 1) to the point that the individual/staff/unit realizes what is missing in digital simulation and can thereby keep the digital training in context and 2) where task performance can be influenced significantly by likely conditions such as temperature, precipitation, or limited visibility. It appears reasonable to argue that those collective tasks representing the low and high end of task complexity (basics and the Ph.D. levels) can be trained in Tactical Engagement Simulation. However, combined arms exercises, such as the Combined Arms Live Fire Exercise (CALFEX), need to be trained full up with actual equipment and service ammunition to ensure training readiness for combat.

4. The focus of this paper is training. There would seem to be powerful opportunities to capitalize on the talent and warfighting experience at the CTCs to advance TRADOC's combat developments at its BattleLabs. Future Doctrine, Tactics Techniques and Procedures, organizations, and material associated with horizontal integration can be "fought" in virtual simulation (SIMNET at Knox today) to establish objective requirements in the same way that a Front End Analysis for force development could be tested at the NTC or JRTC on the ground.

5. For detailed discussion of training programs utilizing Tables/Modules and associated training support and training development, see the following Institute for Defense Analyses (IDA) papers by Frederic J. Brown: A Simulation-Based Intensified Training Readiness Strategy for the Reserve Component,

P-2611, December 1991; Battle Command Staff Training, P-2785, December 1992; Training Third Wave Landpower: Structured Training, P-2947, December 1993.

6. Mastery in certain high-priority individual and collective tasks appears essential, not only to develop proficiency in new capabilities of horizontal integration such that the default capability remains under stress, but also to improve retention through overtraining to mastery.

7. There would appear to be a wide range of opportunities to draw Tables/Modules for assessing training readiness, at least in execution of the "basics" for individual, staff, and small unit.

8. For a visual representation, see Figure 1, A New Paradigm. Then Figures 2, 3, and 4 expand Figure 1 to portray Pre-CTC, CTC, and Post-CTC training. For National Guard units, replace "home station" with "armory" (the paradigm appears relevant for both AC and RC units).

9. The unit would probably train in STX where the tasks had been previously trained to proficiency at the CTC. New tasks involving material that could not be trained at the CTC normally would be trained in Tables/Modules to ensure baseline proficiency, then in STX oriented to force projection METL.

10. This is a genuinely challenging requirement, since resource priorities shift after a unit returns from a rotation at a CTC to home station. But cost, safety, and ecology constrain even the CTC. Full-up force projection, with all multipliers, can only be recreated in virtual or constructive simulation. Therefore, post-CTC mastery level training is essential to actual mission readiness.

11. The tools of the Information Age may be applied to capitalize on the great expertise acquired by the CTC O/Cs. For example, this expertise can be brought to units, staffs, and individuals by new "a ways" in immersing virtual simulation—providing an Information Age Take Home Package, reinforcing the traditional "schoolhouse."

12. These are but several ways to carry out the policy implications of the proposed paradigm. It may be desirable to extend these to a higher level of complexity for the highly trained unit.

13. This would provide a quick-response feedback loop between schoolhouse and unit as well as a start on assessing training readiness at least at the Table/Module level of proficiency.

14. There has been considerable discussion of Third Wave War. The best doctrinal descriptions for landpower applications are OJCS, Doctrine for Joint Operations, Joint Pub 3-0, 1993, and Department of the Army, Operations, Field Manual 100-5, June 1993. The December 1993 *Military Review* has an excellent series of articles discussing evolving AirLand Battle doctrine, now Full-Dimensional Operations. For popular media discussion, see Alvin and Heidi Toffler's "War, Wealth, and a New Era in History," *World Monitor* (May 1991) and *War and Anti-War,* Boston: Little, Brown, 1993. For an attempt to blend the sources above into informed discussion of the implications of Third Wave War, see Frederic J. Brown, *The U.S. Army in Transition II: Landpower in the Information Age*, McLean: Brassey's, 1993.

EPILOGUE

Assessment of Training Readiness

Jack H. Hiller

BACKGROUND

A funny thing happened while the project on the "Determinants of Effective Unit Performance" was underway—the principal threat motivating Army doctrine and training dissipated, while the country's economy retracted and domestic funding needs mounted. Instead of making it easier to achieve and maintain training readiness, the net result of all of these changes has been increased difficulty in defining doctrine and managing training programs that are responsive to changed and changing threat conditions.

THE FUTURE

Future threat scenarios will require the ability to discourage threats or to meet them through direct combat engagements. These threats may emerge "overnight" and may vary from small group terrorist actions to coordinated strikes by the land, air, and naval forces of multiple multination states. They may be arrayed against population centers or military targets and may involve high technology strategic weapons systems or only handguns, rifles, and homemade explosive devices. Broad spectrum contingency planning thus places a premium on training and readiness that is characterized by flexibility, a heightened state of readiness, and by the ability to rapidly plan, organize, train, rehearse, employ, and deploy forces.

The CINCs, Services, and Department of Defense (DOD) components must therefore have the ability quickly to organize and conduct combat exercises, war games, and "what if drills." They should be able to use synthetic environments for developing and testing plans for managing hostilities that may erupt in any geographical area, during any time of the year, under a variety of environmental conditions. Once plans have been

developed, then the appropriate training environments may be used to conduct highly relevant training and mission rehearsals.

Overall, training now and in the foreseeable future cannot safely focus on a singular threat, but must be able to shift to a variety of threat situations. Given the high levels of lethality of weaponry possessed by potential threats and the speed at which conflicts may develop, training readiness must be kept high. Yet, because of the apparent reduction in the military threat from the Eastern Block nations and budgetary pressures at home, it will be difficult to acquire necessary training resources.

The traditional "can do" attitude which is courageous on the battlefield may defeat training management efforts to secure and defend necessary training resources during peacetime. As demonstrated by earlier Congressional pressures to defend OPTEMPO budgets, future training budgets will come under increasing pressures. Emotional pleas to do what is right or to trust command judgment on resource requirements cannot be expected to win. Instead, hard data showing the resources required to achieve and maintain proficiency on valid military tasks offer the best hope for successfully defending training budgets. Below I have outlined an approach for assessing training readiness that can be used to justify training resources.

Initial goals. There are a number of indicators of unit training readiness available that could be immediately incorporated in a revised Unit Status Report. Unit training programs based on METL focus unit combat preparation on the highest priority threats and could motivate improved training because of the accountability inherent in a revised, more detailed Unit Status Report.

Measurement issues. As described earlier in this text, accurate measurement of unit performance is difficult; primary sources of this difficulty are summarized below.

a. **Task Conditions.** At a minimum, precise, rigorously quantifiable measurement requires specification and control of the conditions for performance. However, combat simulations conducted in the field employ conditions which have a great deal of unspecified and uncontrolled variability. The following conditions need to be taken into account:

1. Terrain.

- Terrain at most training sites is extremely variable and hard to describe in precise terms; the specific details of movement and location of friendly troops and the OPFOR adds further variability.
- Terrain differs greatly from one site to another, and from one season to another.

Since terrain conditions critically influence a unit's ability to observe the enemy and employ cover and concealment, uniform application of training standards to units is not feasible in any precisely quantifiable sense. Theoretically, the proficiency of a unit could be estimated by having the unit perform under a variety of conditions, thereby enabling chance factors to cancel out, but resources and cost constraints rule this out. However, as depicted in the preceding paper by F.J. Brown, computer-based simulations may contribute toward cost-effective estimation of leader and unit proficiency by carefully controlling scenarios and their performance conditions.

2. Opposing Forces (OPFOR)

- OPFOR troops necessarily vary considerably in their ability to simulate aggressor troops, enemy doctrine, and tactics.
- OPFOR troop performance will vary from time to time as a function of motivation.

Thus, use of OPFOR troops, who are temporarily brought together, will defeat efforts for uniform, standardized evaluation of unit proficiency. However, we may expect that computer simulation will enable precise specification and control of enemy forces during combat simulations held for training and evaluation.

3. Weather. Again, uncontrolled variability defeats standardization, but computer simulation where applicable will enable control.

b. Observer Problems. The placement of observers for control and evaluation of training is critical to their ability to see what happens and why. However, observers are expensive and thus employed by units in limited numbers. Furthermore, during simulated combat in the field, it is often very diffi-

cult for the observers to see the battle, just as it may be for the participants, because of smoke, darkness, terrain clutter, etc.

c. **Objectivity.** To the extent that unreliable, subjective judgment is required to evaluate a unit's proficiency, poor training and inaccurate evaluation may result. Evaluator training and "calibration" difficulties impede standardization.

d. **Utility.** Resources expended to measure unit proficiency need to be commensurate with need and utility. In general, unit evaluation will need to be accomplished by neighboring units. Leaders who serve as evaluators can learn a great deal from their preparation and experience. But while they fill this role, their own units suffer from reduced leadership. Care must be taken to adjust measurement goals to levels that are affordable.

e. **Fairness.** It is to be expected that an improved, systematic approach toward conducting training and evaluating individual soldier and unit collective proficiency will be reflected in Enlisted Evaluation Reports (EERs) and Officer Evaluation Reports (OERs). As explained above, evaluation of unit tactical proficiency cannot, as a practical matter, be reduced to purely objective measures, given the variability of

- terrain
- OPFOR
- weather
- weapons systems/equipment reliability
- observer problems
- evaluator subjectivity
- unit wartime mission assignments
- missions/tasks sampled for testing proficiency

However, evaluation of unit and individual performance should seek to minimize subjectivity and thereby contribute to increased fairness in performance ratings.

REVISED UNIT STATUS REPORT FOR TRAINING READINESS

a. **Need for Change.** A perennial concern of unit leaders is disruption of unit training by "detractors." Department of the Army, Major Commands (MACOMS), and ARI have over the years conducted extensive research into training detractors, but of course detractors still abound—and they won't go away. Currently ongoing and planned reductions to Base Operations (BASOPS) funding will again force soldiers into performance of civilian garrison support chores. There may always be something "more important" to do than planning, preparing, and conducting or evaluating training. Training quite literally has not counted during periods of reduced world tensions. But, maintenance functions that can be *observed* or *measured* do get attended to, however imperfectly. Personnel forms that must be *filled out* by due dates do get filled out, however imperfectly. There is, therefore, a need to *count training accomplishments,* however imperfectly that may be done.

b. **Approach.** Each battalion and higher unit must use its wartime mission essential task list to structure its training program. Based on resources required and available to conduct training, each unit must establish minimum training requirements within defined reporting periods. Training frequencies estimated by the Standards in Training Commission (STRAC) and by TRADOC task forces (for tasks in the Chief of Staff for Operations (DCSOPS)-Training Battalion Level Training Models) are to be used to initiate the program. Status on the METL is to be reported in the revised Unit Status Report, in addition to the commander's estimate of the time required to bring his unit to wartime readiness. It is anticipated that the following kinds of training accomplishments would be recorded:

- Individual:
  - Percent Qualified with Individual Weapons
  - Percent passed Army Physical Readiness Test

- Percent achieving GO on Common Task Test
- Percent NBC-Qualified
- Percent Leaders-Qualified
- Percent Staff-Qualified

❑ Crews/Teams/Squads/Sections:
- Percent qualified for each identified weapon system
- Percent GO on mission essential drills for each . . .
- Percent GO on mission essential tasks for each . . .

❑ Platoons:
- Percent GO on Drills
- Percent GO on required Situational Training Exercises
- Percent GO on Platoon Test structured to reflect unit METL

❑ Company/Battery & Battalion, and Brigades:
- Percent GO on tasks required by the unit's METL
- Percent Staff functions correctly performed.

As weapons and battlefield simulators become available (e.g., CCTT & CATT), unit performance evaluations based on training on these simulators may be included in the Unit Status Report.

UNIT-SPECIFIC TRAINING AND EVALUATION PROGRAMS

a. Need. Doctrine requires preparation for a "come as you are" battle, and thus requires units to maintain readiness. Given the large number of worldwide contingencies that must be faced, units need to be focused on specifically selected missions and resourced accordingly. A key feature of the proposed concept is recognition of the fact that units cannot achieve high standards on all possible missions. Units must carefully specify their mission essential tasks and plan training consistent with available resources.

b. Approach. It is the commander's responsibility to analyze and assign mission essential training tasks to subordinate units and resource accordingly. TRADOC is responsible for providing the required training program materials. The current paper-based system for ARTEP design, development, production, and distribution cannot keep stride with changes in threat sources, doctrine, and weapons systems on an Army-wide basis; thus, any efforts to custom tailor training programs are not now attempted. However, the Army Training Support Center, with the assistance of ARI, designed a prototype computer-based ARTEP production and distribution system which will have the capability to rapidly tailor training programs to the specific needs of units. The preliminary requirements analysis has been accomplished, and work leading to implementation by TRADOC is underway.

THE GOAL OF UNIT TRAINING

I have saved for last what I believe is the most important point to be presented in this text. The ultimate goal of unit training programs—including any and all training of any sort—is combat readiness. But the tangible goal for the actual *conduct* of training is improved performance capability. Improvement is created by

IDENTIFYING WEAKNESSES (performance evaluation and feedback) in any aspect of preparation for combat (e.g., individual soldier technical skills, synchronization of assets by staff, battle command skills, equipment maintenance), and

CORRECTING WEAKNESSES through immediate replay or through reprogramming of necessary training.

These unremarkable observations belie the difficulties of execution, but more importantly they run counter to the expectations for effective performance held by some senior leaders. Units seen to be making mistakes during training may immediately be judged to have poor leadership. Officer Efficiency Reports typically strain to create significant differences, so

avoiding the appearance of any weaknesses during training tends to displace the true goal of training—improvement.

Newly appointed battalion commanders tend to demand strict adherence to the details of their orders instead of commander's intent. Company commanders studied at the NTC typically lamented that they were not allowed to learn by doing (unpublished study by then Major Sam Endicott and Dr. Earl Pence). In the Determinants study, we found that battalion commander ratings of their company commanders' performance effectiveness correlated *negatively* with performance ratings by neutral NTC Observer/Controllers. The evidence here is that company commanders were rewarded for simply doing what they were told instead of learning how to perform well.

The fact that the "new world order" demands flexibility in doctrine and training provides a new context for training programs. Given frequent changes in doctrine and continuing modernization of the Force, particularly through the adoption of digital technologies, it could be counter-productive for senior leaders to require junior leaders to perform without making mistakes. Once while I was briefing the commander of an allied army on this "zero defect while training" mentality, he explained that his newly appointed commanders are expected to make mistakes. New commanders, he said, are trained, not denigrated or relieved for making mistakes. They are downgraded or relieved only after showing a low ability to improve. Of course I am not arguing here that poor performance during training is always to be tolerated (e.g., visualize an artillery unit throwing wild live rounds), but weak performance by newly appointed junior leaders ought to be evaluated by senior leaders to determine how best to structure and conduct their training. Fortunately, the developing training technologies described by F. J. Brown and Meliza, et al., provide the necessary means.

APPENDIX A

Copy of Card Used by Observer Controllers at the National Training Center to Assess Company-Level Performance

COMPANY/TEAM—CARD 1

CO-TM/BN: ____________ Controlling Task Force ____/____ OC Call Sign ____________

CO-TM's Assigned Mission ______________________________________

____

DTG, Start of Mission: ____________ DTG, End of Mission: ____________

Did the CO/TM successfully accomplish the assigned mission? Circle one: YES NO

If mission was not successfully accomplished, or if friendly losses were unusually high (e.g. casualties, weapons system and/or terrain controlled), were there contributing circumstances beyond the CO/TM's control? Circle one: No Yes

If "Yes," check one or more of the following: ____ Decision(s)/Action(s) by higher hqs.; ____ Overwhelming enemy forces; ____ Other (Please describe on reverse.)

Use the scale below to indicate how the CO/TM performed on each Operating System in each mission Phase:

1 = Inadequate 2 = Borderline 3 = Adequate CR = Can't Rate NA = Not Applicable

Operating System	Planning (Circle One in Each Box)	Preparation (Circle One in Each Box)	Execution (Circle One in Each Box)
Intelligence	1 2 3 CR NA	1 2 3 CR NA	1 2 3 CR NA
Maneuver	1 2 3 CR NA	1 2 3 CR NA	1 2 3 CR NA
Fire Support	1 2 3 CR NA	1 2 3 CR NA	1 2 3 CR NA
Air Defense	1 2 3 CR NA	1 2 3 CR NA	1 2 3 CR NA
Mobility/Countermobility	1 2 3 CR NA	1 2 3 CR NA	1 2 3 CR NA
Combat Service Support	1 2 3 CR NA	1 2 3 CR NA	1 2 3 CR NA
Command and Control	1 2 3 CR NA	1 2 3 CR NA	1 2 3 CR NA

TURN CARD OVER AND COMPLETE REVERSE

COMPANY/TEAM—CARD 1 (Continued)

	TANKS	Bradley IFV/CFV	M113A2	M577A2	M106A2	M901	SQUADS*
START:							
END:							

(* For BDA purposes, four dismounts remaining equals a Squad.)

Please use this space to explain the "Other" circumstances beyond the CO/Team's control (if any). Then give examples of Very Good or Very Poor performance you noticed during the mission.

APPENDIX B

Linkage of Critical Combat Function 23: Provide Countermobility with Each Battlefield Operating System and Other Relevant CCFs

OUTCOMES AND PURPOSE OF CCF 23

OUTCOMES	PURPOSE
1. Obstacles sited to support maneuver concept. 2. Obstacles constructed on time to standard with no bypass available. 3. Responsibility for obstacles with Maneuver Commander. 4. Obstacles secured, with gaps closed, covered by fire. 5. FASCAM ready for employment; its use supports the maneuver plan and the employment criteria are understood by key personnel.	To delay, channel, or stop offensive movement by the enemy in order to destroy his forces directly or indirectly by enhancing the effectiveness of friendly direct and indirect weapons systems.

STRUCTURE OF CRITICAL COMBAT FUNCTIONS RELEVANT TO BATTALION TASK FORCE OPERATIONS

Critical Combat Function

The integration of related players and tasks that represent a source of combat power. The synchronization of critical combat functions provides maneuver commanders at any echelon with a definable outcome that materially affects the battle.

I. **Intelligence BOS**—The ways and means of acquiring, analyzing, and using knowledge of the enemy, weather, and terrain required by a commander in planning, preparing, and conducting combat operations. These CCFs are continuous throughout the planning, preparation, and execution phases of the battle.

1. **CCF (1) Conduct Intelligence Planning**—The development and coordination of information relative to the enemy, weather, and terrain prior to and during the development of the unit OPORD; the planning to collect information from battlefield sources and to acquire intelligence from other headquarters. Focus of this CCF is the Intelligence Preparation of the Battlefield (IPB). This CCF addresses
   a. Reconnaissance and Surveillance plan.
   b. Integrated threat templates (doctrinal; event; input to DST).
   c. Terrain and weather analysis.
2. **CCF (2) Collect Information**—Obtaining information in any manner from TF elements and from sources outside the TF (e.g., higher headquarters, adjacent units). This CCF includes the tasks associated with managing the processes and activities necessary to collect battlefield information which may eventually be used to provide intelligence relative to the enemy, terrain, and weather. This CCF addresses
   a. Information collected as a result of R & S plan.
   b. Continuous information collection and acquisition from all sources.

3. **CCF (3) Process Information**—The conversion of information into intelligence through collation, evaluation, analysis, integration, and interpretation in a continual process. This CCF addresses
   a. Evaluation of threat information.
   b. Evaluation of physical environment information.
   c. Integration of intelligence information.
   d. Development of enemy intentions.
   e. Development of targeting information.
   f. Preparation of intelligence reports.
   g. Update of situational template.
   h. Provision of battlefield area reports.
4. **CCF (4) Disseminate Intelligence**—Transmission of information by any means (verbal, written, electronic, etc.), from one person or place to another to provide timely dissemination of critical intelligence to all appropriate members of the combined arms team. This CCF addresses
   a. The sending of processed intelligence in a timely manner to those on the combined arms team who can, by its receipt, take appropriate actions to accomplish the mission. This includes intelligence on the enemy, terrain, and weather.
   b. The sending of raw intelligence directly from those responsible for reconnaissance and surveillance to the commander should that raw intelligence be time sensitive (and not be subject to receipt and processing by intelligence analysts).
   c. Dissemination of battlefield reports.

II. **Maneuver BOS**—The employment of direct fire weapons, platforms, and systems through movement and fire and maneuver to achieve a position of advantage in respect to enemy ground forces in order to accomplish the mission. The direct fire weapons are tank guns; BFV 25mm; antitank guns and rockets; attack

helicopter guns and rockets; small arms; crew served weapons; directed energy weapons systems.

1. **CCF (5) Conduct Tactical Movement**—Position direct fire weapons systems relative to the enemy to secure or retain positional advantage making full use of terrain and formations. Tactical movement occurs when contact with the enemy is likely or imminent but direct fire engagement has not yet occurred. Units supporting maneuver units are included. This CCF addresses
   a. Subordinate element OPORD preparation and dissemination.
   b. Preparation for movement.
   c. Movement, mounted and dismounted; on and off road.
   d. Closure of movement—tactical assembly area; tactical positions.
   e. Navigation.
   f. Force protection.
   g. Air movement.
2. **CCF (6) Engage Enemy with Direct Fire and Maneuver**—Entering into ground combat with the enemy using direct fire and/or close combat in order to destroy the enemy or cause him to withdraw. This CCF relates only to those direct fire weapons systems associated with the Maneuver BOS. This CCF is initiated with the OPORD at the completion of the planning phase of the battle and includes all tasks associated with subordinate echelon planning, preparation, and execution of the battle. This CCF addresses
   a. Subordinate element OPORD preparation and dissemination.
   b. Preparation of engagement areas.
   c. Rehearsals of battle plans.
   d. Pre-combat prepare to fire checks.
   e. Target acquisition.
   f. Fire control and distribution.

g. Fratricide.
h. Conduct close combat.
i. Integration of direct fire with maneuver.
j. Control of terrain.
k. Prestocked ammunition.
l. Resupply during operations.
m. Maintenance during operations.
n. Consolidation and reorganization.

III. **Fire Support BOS**—The collective, coordinated, and synchronized use of target acquisition data, indirect fire weapons, armed aircraft (less attack helicopters), and other lethal and nonlethal means against ground targets in support of maneuver force operations and to achieve the commander's intent and scheme of maneuver. The Fire Support BOS addresses these weapons: mortars; field artillery; close air support; electronic measures; naval gunfire.

1. **CCF (7) Employ Mortars**—Employment of mortars by the maneuver unit to place fires on the enemy or terrain to support the commander's concept and intent. This CCF initiates with the receipt of an OPORD by the maneuver commander and addresses those tasks required during the preparation and execution phases of the battle. This CCF addresses
   a. Subordinate element OPORD preparation and dissemination.
   b. Prepare to fire checks.
   c. Pre-combat checks.
   d. Development of order to fire.
   e. Tactical movement.
   f. FDC operations.
   g. Target engagements with illumination, smoke, HE.
   h. Sustainment operations.
   i. Rehearsals.
2. **CCF (8) Employ Field Artillery**—The ways and means employed by the maneuver unit to cause

indirect artillery fires to be placed on the enemy or terrain to support the commander's concept and intent. This CCF initiates upon receipt of an OPORD by the maneuver commander and includes tasks performed during the preparation and execution phases of the battle. The Fire Support Coordination tasks necessary to integrate the field artillery and the maneuver units are the primary focus. This CCF does not address those field artillery tasks associated directly with those actions taken by the batteries of the artillery battalion in the conduct of their support mission such as FDC operations, gun operations, etc. This CCF addresses

a. Fire Support—Maneuver unit rehearsals.

b. FSE operations during the preparation and execution phase of the battle.

c. FSO and FIST operations in coordination with their maneuver commander.

d. Positioning and movement within the maneuver unit sector or zone.

e. Indirect fire missions in support of maneuver commander's concept and intent.

f. Sustainment operations.

g. Indirect fire planning as battlefield METT-T change.

3. **CCF (9) Employ Close Air Support**—Planning for, requesting, and employing armed aircraft (less attack helicopters) in coordination with other fire support (lethal and nonlethal) against ground targets in support of the maneuver force commander's concept and intent. This CCF addresses

a. Air-ground attack requests.

b. Airspace coordination and management.

c. Air Liaison Officer, Forward Air Controller, other Army Fire Support Coordination Officer, USN/USMC Brigade Commander, SALT-O and FCT-O tasks that enable air to ground attacks.

4. **CCF (10) Conduct Electronic Collection and Jamming**—Actions taken to deny the enemy effective command, control and communications of his own tactical force in support of maneuver commander's concept and intent. This CCS includes jamming, deception, and collection.

5. **CCF (11) Conduct Battlefield PsyOps**—Conduct psychological activities as an integral part of combat operations to bring psychological pressure to bear on enemy forces and civilians under enemy control in the battle area, to assist in the achievement of tactical objectives in support of maneuver commander's concept and intent.

6. **CCF (12) Employ Chemical Weapons**—Employ chemical agents or other means to degrade enemy capabilities in support of maneuver commander's concept and intent.

7. **CCF (13) Conduct Counter Target Acquisition Operations**—Suppress (e.g., using smoke or dazzling illumination) or degrade enemy direct observation, optics, radar, sensors, electronic DF equipment, and imaging systems in support of maneuver commander's concept and intent.

8. **CCF (14) Employ Naval Gunfire**—The means and ends to provide naval gunfire in support of the maneuver commander's tactical operation.

9. **CCF (15) Coordinate, Synchronize, and Integrate Fire Support**—Coordination of all fire support means in support of the maneuver commander's concept and intent. This CCF addresses the preparation and execution of tasks necessary to integrate the fire support detailed in the OPORD. The CCF integrates CCF 7-14 in support of maneuver commander's concept and intent.

IV. **Air Defense BOS**—The means and measures organic or assigned to the maneuver commander which, when employed, successfully will nullify or reduce the effectiveness of attack by hostile aircraft or missiles after they are airborne.

1. **CCF (16) Take Active Air Defense Measures**—Application of firepower to destroy enemy air targets. This CCF addresses the coordinating tasks which enable the maneuver commander to successfully employ any attached or assigned air defense weapons system as well as the tasks necessary to employ all organic weapons systems against enemy air targets. This CCF addresses
   a. Employment of Air Defense Artillery guns and missiles.
   b. Employment of maneuver unit weapons systems such as small arms, automatic weapons, BFV 25 mm and TOW missiles, tank main gun against enemy air.
   c. Airspace management.
   d. Early warning.
   e. Sustainment.
2. **CCF (17) Take Passive Air Defense Measures**—The protection of the maneuver force from enemy air by means other than weapons. This CCF will focus on the preparation and execution phases of the battle. This CCF addresses
   a. Early warning.
   b. Dispersion.
   c. Cover and concealment.
   d. Air watch.
   e. Deception.

V. **Command and Control BOS**—The ways and means a maneuver commander exercises authority and direction over organic and assigned combat power in the accomplishment of the mission.

1. **CCF (18) Plan for Combat Operations**—The integration of all members of the combined arms team in the coordinated development of the maneuver unit Operations Order, which will guide the activities of the combined arms team in conducting combat operations to accomplish assigned missions. The product/outcome of this CCF is a briefed, understood OPORD. This CCF addresses

a. Receipt and analysis of higher HQ OPORD.
b. Issuance of Warning Order.
c. Restated mission statement.
d. Commander's estimate process/troop leading procedures.
e. Commander's guidance.
f. Mission analysis (includes course of action development).
g. Decision brief to commander.
h. Development of a synchronized OPORD.
i. Reproduction and distribution of OPORD to all participants.
j. Briefing of OPORD; understanding of order by participants.
k. FRAGO planning and issue.

2. **CCF (19) Direct and Lead Unit During Preparation for the Battle**—The ways and means to prepare combined arms task force for the battle so that the combined arms task force is ready to support the maneuver commander's concept and intent. This CCF addresses
   a. Commander's activities.
   b. Communicating information.
   c. Briefbacks and backbriefs.
   d. Rehearsals.
   e. Management of the means of communicating information.
   f. Maintaining and updating information and force status.
   g. Managing information distribution.
   h. Decisions to act or change ongoing actions.
   i. Confirming IPB through the reconnaissance effort.
   j. Determining actions to implement decisions.
   k. Providing command presence.
   l. Maintaining unit discipline.

m. Synchronizing tactical operations (e.g., execution matrix DST).

n. TOC operations (e.g., staff integration and battle tracking).

o. Continuity of command.

p. Second in command (2IC responsibilities).

q. Continuous and sustained operations.

r. Communications (e.g., planning, installation, and operation of system, management, site selection).

3. **CCF (20) Direct and Lead Units in Execution of Battle**—The ways and means to command and control in the combined arms task force execution of the battle plan (engaging the enemy in battle) to accomplish the maneuver commander's concept and intent. This CCF addresses

   a. Directing the conduct of the battle.

   b. Issue orders.

   c. Command presence.

   d. Information distribution.

   e. Decide on need for action or change.

   f. Maintaining unit discipline.

   g. Synchronizing tactical operations.

   h. TOC operations (includes CP displacement, security, survivability).

   i. Continuity of command (e.g., C2 redundancy).

   j. Second in command (2IC) responsibilities.

   k. Continuous and sustained operations.

   l. Consolidation and reorganization.

VI. **Mobility and Survivability BOS**—The ways and means of the force that permit freedom of movement, relative to the enemy, while retaining the task force ability to fulfill its primary mission as well as the measures the force takes to remain viable and functional by protection from the effects of enemy weapons systems and natural occurrences.

1. **CCF (21) Overcome Obstacles**—Enabling the maneuver force to maintain its mobility by removing or clearing/reducing natural and manmade obstacles. This CCF will initiate after receipt of the OPORD and address subordinate echelon planning as well as task force preparation and execution tasks necessary to achieve the maneuver commander's concept and intent. This CCF addresses
   a. Breach obstacle. Clearing a path or lane for personnel and equipment through a battlefield obstacle.
   b. Cross gaps. Passing through or over any battlefield terrain feature, wet or dry, that is too wide to be overcome by organic/self bridging.
2. **CCF (22) Enhance Movement**—Provision of adequate mobility for the maneuver unit in its area of operations. This CCF addresses
   a. Construction and repair of combat roads and trails.
   b. Construction or repair of forward airfields.
   c. Facilitating movement on routes. (This includes control of road traffic and control of refugees and stragglers.)
   d. Tracking status of routes.
   e. Host nation support.
3. **CCF (23) Provide Countermobility**—Delaying, channeling, or stopping offensive movement by the enemy consistent with the commander's concept and intent by enhancing the effectiveness of friendly direct and indirect weapons systems. This CCF addresses
   a. Emplacement of mines and complex obstacles.
   b. Digging tank ditches.
   c. Creation of road craters with explosives.
   d. Terrain enhancement.
4. **CCF (24) Enhance Physical Protection**—Providing protection of friendly forces on the battlefield by enhancing the physical protection of personnel,

equipment, and weapons systems and supplies. This CCF addresses

a. Construction of fighting positions.

b. Preparation of protective positions.

c. Employment of protective equipment.

5. **CCF (25) Provide Operations Security**—Denying information to the enemy about friendly capabilities and intentions by identifying, controlling, and protecting indicators associated with planning and conducting military operations. This CCF addresses

a. Analysis to determine key assets and threats to them.

b. Cover and concealment.

c. Camouflage.

d. Noise and light discipline.

e. Counter reconnaissance.

f. Smoke/obscurants.

g. Physical security measures.

h. Signal security.

i. Electronic security.

6. **CCF (26) Conduct Deception Operations**—Taking actions to mask the real objectives of tactical operations in order to delay effective enemy reaction. This CCF addresses

a. Physical deception.

b. Electronic deception.

7. **CCF (27) Provide Decontamination**—Making any person, object, or area safe by absorbing, destroying, neutralizing, making harmless, or removing chemical or biological agents, or by removing radioactive material. This CCF addresses

a. Decontamination of individual soldiers and equipment.

b. Decontamination of weapon systems and supplies.

c. Hasty and deliberate decontamination.

VII. **Combat Service Support BOS**—The support, assistance, and service provided to sustain forces, primarily in the area of logistics, personnel services, and health services.

1. **CCF (28) Provide Transport Services**—Providing or coordinating for transportation which will assure sustainment support operations in support of the maneuver commander. Upon receipt of an OPORD, this CCF addresses preparation and execution tasks necessary to achieve transportation support of the maneuver force. This CCF addresses
   a. Movement of cargo, equipment, and personnel by surface or air.
   b. Loading, transloading, and unloading material and supplies.
2. **CCF (29) Conduct Supply Operations**—Providing the items necessary to equip, maintain and operate the force during the preparation and execution phases of the battle. This CCF addresses
   a. Requesting, receiving, procuring, storing, protecting, relocating and issuing supplies to the specific elements of the force.
   b. Providing munitions to weapons systems.
   c. Providing fuel and petroleum products to equipment and weapons systems.
   d. Reporting status.
3. **CCF (30) Provide Personnel Services**—Management and execution of all personnel-related matters to sustain the force. This CCF addresses
   a. Personnel Administrative Services.
      1) Replacement, casualty reporting.
      2) Awards and decorations.
      3) Postal Operations.
      4) Promotions, reductions.
   b. Financial services.
   c. Unit Ministry team.
   d. Legal.
   e. Public Affairs.

f. Reporting personnel status.

g. Preservation of the force through safety.

h. Management of stress.

4. **CCF (31) Maintain Weapons Systems and Equipment**—Preservation and repair of weapons systems and equipment. This CCF includes the provision of repair parts and end items to all members of the combined arms team before, during, and after the battle. Included also is doctrinal echeloning of maintenance (organization, DS, GS). This CCF addresses

   a. Preventative Maintenance.

   b. Recovery.

   c. Diagnosis, substitution, exchange, repair and return of equipment and weapons systems to the combined arms force.

   d. Reporting status.

5. **CCF (32) Provide Health Services**—Performance, provision, or arrangement for health services regardless of location, to promote, improve, conserve, or restore the mental or physical well-being of individuals or groups. This CCF addresses

   a. Preventive medicine.

   b. Field sanitation.

6. **CCF (33) Treat and Evacuate Battlefield Casualties**—Application of medical procedures on battlefield casualties beginning with "buddy aid" through trained medical personnel. The CCF includes movement of casualties from the forward edge of the battlefield back to division-level medical facilities. This CCF addresses

   a. Triage of battlefield casualties.

   b. Treatment and movement of casualties to rear (medevac).

      1) Identification of levels of care and locations.

      2) Synchronization and coordination of movement of medical facilities to ensure continuity of care.

3) Establishment and maintenance of communications with redundant means.

4) Rehearsals.

5) Resupply.

c. Evacuation

1) Ground ambulance.

2) Aero medevac.

3) Non-standard evacuation.

d. Handling and processing the remains of soldiers who have died of wounds.

e. Reporting status.

7. **CCF (34) Conduct Enemy Prisoners of War (EPW) Operations**—The collection, processing, evacuation, and safeguarding of enemy prisoners of war. This CCF addresses

a. Collecting and evacuating EPW.

b. Searching, segregating, safeguarding, silencing, and rapid rearward movement of EPW.

8. **CCF (35) Conduct Law and Order Operations**—Enforcement of laws and regulations and maintenance of units and personnel discipline.

9. **CCF (36) Conduct Civil Affairs Operations**—Conduct of those phases of the activities of a tactical commander which embrace the relationship between the military forces and civil authorities and the citizens in a friendly or occupied country or area when U.S. military forces are present.

10. **CCF (37) Provide Sustainment Engineering**—The repair and construction of facilities and lines of communication. This CCF addresses

a. Rear area restoration.

b. Construction and maintenance of lines of communication (roads, railroads, ports, airfields).

c. Construction support:

1) Marshaling, distribution, and storage facilities.

2) Pipelines.

3) Fixed facilities.
4) Drill wells.
5) Dismantlement of fortifications.

11. **CCF (38) Evacuate Non-Combatants From Area of Operations**—The use of available military and host-nation resources for the evacuation of U.S. forces, dependents, U.S. government civilian employees, and private citizens (U.S. and other). This CCF addresses
    a. Medical support.
    b. Transportation.
    c. Security.
    d. Preparation of temporary shelters.
    e. Operation of clothing exchange facilities.
    f. Operation of bathing facilities.
    g. Graves registration.
    h. Laundry.
    i. Feeding.
12. **CCF (39) Provide Field Services**—Performance of service logistics functions by and for Army elements in the field. This CCF addresses
    a. Clothing exchange.
    b. Bathing facilities.
    c. Graves registration.
    d. Laundry and clothes renovation.
    e. Bakeries.
    f. Feeding (rations supply, kitchens).
    g. Salvage.

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